



Data handbook



Electronic components and materials

Semiconductors

Book S8b

1986

Optoelectronic devices

OPTOELECTRONIC DEVICES

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DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

ELECTRON TUBES

BLUE

SEMICONDUCTORS

RED

INTEGRATED CIRCUITS

PURPLE

COMPONENTS AND MATERIALS

GREEN

The contents of each series are listed on pages iv to viii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.

Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises: Tubes for r f heating

T1

11	tubes for r.i. neating	
T2a	Transmitting tubes for communications, glass types	
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Т6	Geiger-Müller tubes	
T8	Colour display systems Colour TV picture tubes, colour data graphic display tube assemble to the colour tube assemble to the colour data graphic display tube assemble to the colour data graphic data graphi	blies, deflection units
Т9	Photo and electron multipliers	
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T13	Image intensifiers and infrared detectors	
T15	Dry reed switches	
T16	Monochrome tubes and deflection units Black and white TV picture tubes, monochrome data graphic dis	play tubes, deflection units

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

S1	$\label{eq:Diodes} \textbf{Diodes} \\ \textbf{Small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes} \\$
S2a	Power diodes
S2b	Thyristors and triacs
S3	Small-signal transistors
S4a	Low-frequency power transistors and hybrid modules
S4b	High-voltage and switching power transistors
S 5	Field-effect transistors
S6	R.F. power transistors and modules
S7	Surface mounted semiconductors
S8a	Light-emitting diodes
S8b	Devices for optoelectronics Optocouplers, photosensitive diodes and transistors, infrared light-emitting diodes and infrared sensitive devices, laser and fibre-optic components
S9	Power MOS transistors
S10	Wideband transistors and wideband hybrid IC modules
S11	Microwave transistors
S12	Surface acoustic wave devices
S13	Semiconductor sensors
S14	Liquid Crystal Displays

^{*}To be issued shortly.

INTEGRATED CIRCUITS (PURPLE SERIES)

The NEW SERIES of handbooks is now completed. With effect from the publication date of this handbook the "N" in the handbook code number will be deleted. Handbooks to be replaced during 1986 are shown below.

The purple series of handbooks comprises:

IC01	Radio, audio and associated systems Bipolar, MOS	new issue 1986 IC01N 1985
IC02a/b	Video and associated systems Bipolar, MOS	new issue 1986 IC02Na/b 1985
IC03	Integrated circuits for telephony Bipolar, MOS	new issue 1986 IC03N 1985
IC04	HE4000B logic family CMOS	new issue 1986 IC4 1983
IC05N	HE4000B logic family — uncased ICs CMOS	published 1984
IC06N	High-speed CMOS; PC74HC/HCT/HCU Logic family	published 1986
IC08	ECL 10K and 100K logic families	New issue 1986 IC08N 1984
IC09N	TTL logic series	published 1986
IC10	Memories MOS, TTL, ECL	new issue 1986 IC7 1982
IC11N	Linear LSI	published 1985
Supplement to IC11N	Linear LSI	published 1986
IC12	I ² C-bus compatible ICs	not yet issued
IC13	Semi-custom Programmable Logic Devices (PLD)	new issue 1986 IC13N 1985
IC14N	Microprocessors, microcontrollers and peripherals Bipolar, MOS	published 1985
IC15	FAST TTL logic series	new issue 1986 IC15N 1985
IC16	CMOS integrated circuits for clocks and watches	first issue 1986
IC17	Integrated Services Digital Networks (ISDN)	not yet issued
IC18	Microprocessors and peripherals	new issue 1986*

^{*} The Microprocessors were included in handbook IC14N 1985, so IC18 will replace that part of IC14N.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C2	Television tuners, coaxial aerial input assemblies, surface acoustic wave filters
C3	Loudspeakers
C4	Ferroxcube potcores, square cores and cross cores
C 5	Ferroxcube for power, audio/video and accelerators
C6	Synchronous motors and gearboxes
C7	Variable capacitors
C8	Variable mains transformers
С9	Piezoelectric quartz devices
C11	Varistors, thermistors and sensors
C12	Potentiometers, encoders and switches
C13	Fixed resistors
C14	Electrolytic and solid capacitors
C15	Ceramic capacitors
C16	Permanent magnet materials
C17	Stepping motors and associated electronics
C18	Direct current motors
C19	Piezoelectric ceramics
C20	Wire-wound components for TVs and monitors
C22	Film capacitors

July 1986



SELECTION GUIDE

OPTOCOUPLERS

Standard types, UL recognized and VDE approved

Transistor output

type	case	C.T.R.		V _{CEsat}	VIORM	M ton/toff (typ.)		V(BR)CEO	page ·
		I _F = 10 mA V _{CE} = 0,4 V	I _F = 10 mA I _C = 2 mA kV (a.c.)		$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$		•		
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{off} (μs)	min. (V)	
CNX35U	SOT-90B	0,4	0,9	0,4	4,4	3	3	30	99
CNX39U	SOT-90B	0,6	1,0	0,4	4,4	5,5	4	30	99
CNX36U	SOT-90B	0,8	2,0	0,4	4,4	8	6	30	99
CNY57U	SOT-90B	0,2	0,8	0,4	4,4	3	3	30	233
CNY57AU	SOT-90B	0,4		0,4	4,4	5*	5*	30	233

^{*} $I_{C} = 4 \text{ mA}$.

High-voltage transistor output

type	case	C.T.R.		V _{CEsat}	VIORM	ton/toff (typ.)		V(BR)CEO	page
				IF = 16 mA IC = 2 mA	kV (a.c.)	$I_C = 4 \text{ mA}; V_{CC} = 5 \text{ V};$ R _L = 100 \Omega			
		min. max. max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)			
CNX38U	SOT-90B	0,7	2,1	0,4	4,4	5	5	80	131

Darlington transistor output

type	case	C.T.R.		C.T.R. VCEsat VIORM ton/toff (t		/p.)	V(BR)CEO	page	
		I _F = 1 mA V _{CE} = 1 V		I _F = 5 mA I _C = 10 mA	kV (a.c.)	$I_F = 1 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega; R_{BE} = 1 \text{ M}\Omega$			
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX48U	SOT-90B	5,0		1,0	4,4	5	30	30	159

219

219

Standard types

CNY57

CNY57A

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Transistor output

type	case	I _F = 10 mA I _F =		C.T.R. VCEsat VIORM ton		ton/toff (ty	γp.)	V(BR)CEO	page
				IF = 10 mA IC = 2 mA	1.)/ ()	IC = 2 mA; RL = 100 S	V _{CC} = 5 V;		
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX35 CNX39 CNX36	SOT-90B SOT-90B SOT-90B	0,4 0,6 0,8	0,9 1,0 2,0	0,4 0,4 0,4	4,4 4,4 4,4	3 5,5 8	3 4	30 30 30	83 83 83

3

5

5

30

30

SOT-90B

SOT-90B

0,2

0,4

0,8

0,4

0,4

type case	case	case C.T.R.		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page
		IF = 10 mA VCE = 0,4 V IC = 2 mA			$I_C = 4 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$				
		min.	max.		kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX38	SOT-90B	0,7	2,1	0,4	4.4	5	5	80 -	115

4,4

4,4

Darlington transistor output

type case		C.T.R.		V _{CEsat}	VIORM	ton/toff (typ.)		V(BR)CEO	page
		I _F = 1		I _F = 5 mA; I _C = 10 mA	kV (a.c.)	I _F = 1 mA; R _L = 100 Ω	V _{CC} = 5 V; ; R _{BE} = 1 MΩ		
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	miņ. (V)	
NX48	SOT-90B	5,0		1,0	4,4	5	30	30	147

Other standard types, UL recognized or pending, VDE approved.

Transistor output

type	case	C.T.R		VCEsat	VIORM	ton/toff(ty	p.)	V(BR)CEO	page
			I _F = 1 VCE =	0 mA = 10 V	IF = 50 mA IC = 2 mA	13//	I _C = 2 mA; R _L = 100 Ω	V _{CC} = 10 V;	
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
4N25	SOT-90B	0,2		0,5	2,820	3	3	30	291
4N25A	SOT-90B	0,2		0,5	2,820	3	3	30	291
4N26	SOT-90B	0,2		0,5	2,820	3	3	30	291
4N27	SOT-90B	0,1		0,5	2,820	3	3	30	291
4N28	SOT-90B	0,1		0,5	2,820	3	3	30	291

type	case	C.T.R		V _{CEsat}	VIORM	ton/toff (ty	p.)	V(BR)CEO	page
		IF = 10 mA VCE = 10 V		IF = 10 mA IC = 0,5 mA		I _C = 2 mA; R _L = 100 S	V _{CC} = 10 V;		
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
4N35	SOT-90B	1,0		0,3	4,4	7	5	30	×
4N36	SOT-90B	1,0		0,3	2,820	7	5	30	x
4N37	SOT-90B	1,0		0,3	2,820	7	5	30	×
H11A1	SOT-90B	0,5		0,4	2,820	3*	3*	30	259
H11A2	SOT-90B	0,2		0,4	2,820	3*	3*	30	259
H11A3	SOT-90B	0,2		0,4	2,820	3*	3*	30	259
H11A4	SOT-90B	0,1		0,4	2,820	3*	3*	30	259
H11A5	SOT-90B	0,3		0,4	2,820	3*	3*	30	×

 $[\]boldsymbol{x} \; : \; \mathsf{Data} \; \mathsf{sheet} \; \mathsf{available} \; \mathsf{on} \; \mathsf{request}, \; \mathsf{UL} \; \mathsf{recognition} \; \mathsf{pending}.$

SELECTION GUIDE

type	case	C.T.R. V _{CEsat} V _{IORM} t _{on} /t _{off} (typ.)		V(BR)CEO	page				
		IF = 1 VCE =	0 mA = 10 V	IF = 60 mA	kV (a.c.) peak value	$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V};$ $R_L = 100 \Omega$			
		min.	max.	max. (V)		t _{on} (μs)	t _{Off} (μs)	min. (V)	
MCT26	SOT-90B	0,06		0,5	4,4	3*	3*	30	271

type	case	C.T.R. V _{CEsat}		V _{CEsat}	VIORM kV (a.c.)	ton/toff (ty	p.)	V(BR)CEO	page
		I _F = 10 mA V _{CE} = 10 V		IF = 16 mA IC = 2 mA		I_F = 20 mA; V_{CC} = 5 V; R_L = 2 k Ω ; R_{BE} = 100 K Ω			
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
MCT2	SOT-90B	0.2		0.4	4.4	5	10	30	265

High-voltage transistor output

type	case	C.T.R. IF = 10 mA VCE = 10 V		VCEsat	VIORM	ton ^{/t} off (ty	rp.)	V(BR)CEO	page
				IF = 20 mA IC = 4 mA	kV (a.c.)	IC = 2 mA; R _L = 100 S	V _{CC} = 10 V;		
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{off} (μs)	min. (V)	
4N38	SOT-90B	0,1		1,0	2,820	5	5	80	×
4N38A	SOT-90B	0,1		1,0	2,820	5	5	80	×

 \boldsymbol{x} : Data sheet available on request, UL recognition pending.

High-voltage transistor output (cont.)

type	case	C.T.R.		VCEsat VIORM		ton/toff(ty	p.)	V(BR)CEO	page
		I _F = 10 V _{CE} =		IF = 10 mA IC = 2,5 mA	$I_{C} = 2 \text{ mA}; V_{CC} = 10 \text{ V};$ $R_{L} = 100 \Omega$				
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNY17-1	SOT-90B	0,4	0,8	0,3	4,4	5	5	70	×
CNY17-2	SOT-90B	0,63	1,25	0,3	4,4	5	5	70	x
CNY17-3	SOT-90B	1,0	2,0	0,3	4,4	5	5	70	×

Darlington transistor output

type	ype case		C.T.R. V _{CEsat} V _{IORM}		VIORM	t _{on} /t _{off} (ty	rp.)	V(BR)CEO	page
		IF = 1 VCE =	mA = 5 V	I _F = 1 mA	kV (a.c.)	I _C = 10 mA R _L = 100 S	A; V _{CC} = 10 V;	min. (V)	
		min.	max.	max. (V)	peak value	·	t _{Off} (μs)		
H11B1	SOT-90B	5,0		1,0	2,820	125	100	25	x
H11B2	SOT-90B	2,0		1,0	2,820	125	100	25	×
H11B3	SOT-90B	1,0		1,0	2,820	125	100	25	×

type	case	ase C.T.R.		VCEsat	VIORM	ton/toff (ty	rp.)	V(BR)CEO	page
		IF = 10 mA VCE = 5 V IC = 50 mA		kV (a.c.)	$I_C = 10 \text{ mA}; V_{CC} = 10 \text{ V};$ $R_L = 100 \Omega$				
		min.	max.	max. (V)	peak value	t _{on} (μs) t _{off} (μs)		min. (V)	
H11B255	SOT-90B	1,0		1,0	2,820	125	100	55	х

x : Data sheet available on request, UL recognition pending.

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Other standard types, UL recognized or pending, VDE approved.

Darlington transistor output (cont.)

type case		C.T.R		VCEsat	VIORM	t _{on} /t _{off} (ty	p.)	V(BR)CEO	page
		IF = 1 VCE	10 mA = 5 V	I _F = 50 mA; I _C = 50 mA	kV (a.c.)	I _F = 10 mA R _L = 100 Ω	x; V _{CC} = 5 V; 2		
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
MCA230	SOT-90B	1,0		1,0	4,4	5	100	30	х
MCA231	SOT-90B	2,0		1,2*	4,4	5	100	30	×
MCA255	SOT-90B	1,0		1,0	4,4	5	100	55	×

^{*} I_F = 10 mA

Types for mains applications, UL recognized, VDE approved

type		C.T.R.		VCEsat	VIORM	ton/toff(ty	p.)	V(BR)CEO	page
		I _F = 1 VCE =	I _F = 10 mA V _{CE} = 0,4 V	IF = 10 mA kV (a.c.)	I _C = 2 mA; R _L = 100 S	V _{CC} = 5 V;			
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX62	SOT-174	0,4		0,4	5,3	3	3	50	171
CNX72	SOT-90B	0,4		0,4	5,3*	26	2,5 * *	30	183
CNX82	SOT-212	0,4		0,4	5,3	3	3	50	195
CNX83	SOT-212	0,4		0,4	5,3	3	3	50	207

- * VDE approved for 4,4 kV. ** Max. values, $R_{BE} = 56 \text{ k}\Omega$.
- Notes: CNX83, UL and VDE approval pending.

CNX82 and CNX83, pin distance 10,16 mm. CNX62 and CNX82 have no base connection.

 \boldsymbol{x} : Data sheet available on request, UL recognition pending.

Types with input/output pin distance 15,24 mm

type	case	C.T.R.		V _{CEsat}	VIORM	ton/toff (ty	p.)	V(BR)CEO	page
		IF = 10 mA VCE = 0,4		IF = 10 mA IC = 2 mA		$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$			
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX21	SOT-211	0,2		0,4*	10	3	2,5**	30	75
CNY62	SOT-91B	0,25		0,4	5,3	3	3	50	247
CNY63	SOT-91B	0,5		0,4 ^{&}	4,4	5	5	30	247

- * Typ. value.
- ** $t_r/t_f (V_{CC} = 20 \text{ V}).$
- ▲ I_C = 4 mA

Types for telephony applications, recognized by French CNET

type	type case		C.T.R. V _{CEsat} V		VIORM	ton/toff (ty	V(BR)CEO	page	
		IF = 2 mA VCE = 5 V		I _C = 50 mA		I _C = 16 mA; V _{CC} = 5 V; R _L = 1 kΩ			
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
SL5500	SOT-90B	0,3		0,4	2,5	20	50	30	×

type	case	C.T.R		VCEsat	VIORM	ton/toff (ty	/p.)	V(BR)CEO	page
		IF = 2 VCE		IF = 10 mA; IC = 0,5 mA		I _C = 16 mA R _L = 1 kΩ	A; V _{CC} = 5 V;		171
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
SL5501	SOT-90B	0,15		0,4	2,5	20	50	30	×

 ${\bf x}:{\sf Data}$ sheet available on request.

Tirmon for	4alamban.,	applications,		L	CNIET	1
I voes for	telephony	applications.	recognized	υv	CIVE	(COIIL

type	case	C.T.R.		V _{CEsat}	VIORM	t _{on} /t _{off} (ty	p.)	V(BR)CEO	page
		I _F = 2 mA V _{CE} = 5 V		I _F = 20 mA I _C = 1 mA	kV (a.c.)	I _C = 10 mA R _L = 1 kΩ	; V _{CC} = 10 V;		
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{off} (μs)	min. (V)	
SL5502R	SOT-211	0,20		0,3	2,5	25	25	32	×

type	case	C.T.R.		V _{CEsat}	V _{CEsat} V _{IORM}		p.)	V(BR)CEO	page
		I _F = 2 mA V _{CE} = 5 V		IF = 20 mA; IC = 2 mA		IC = 16 mA RL = 1 kΩ	x; VCC = 5 V;		
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
SL5504	SOT-90B	0,15		0,4	2,5	50	100	80	x
SL5511	SOT-90B	0,25		0,4	2,5	20	50	30	x

New generation of optocouplers with GaAlAs emitter diode

Low current types, transistor output

type	case	Case C.T.R. IF = 10 mA VCE = 0,4 V		VCEsat	VIORM	ton/toff (ty	p.)	V(BR)CEO	page
				IF = 10 mA; IC = 2 mA		$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$			
		min.	max.	max. (V)	kV (a.c.) peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNG35 CNG36	SOT-90B SOT-90B	0,4 0,8	0,9 2,0 1,0* 0,6**	0,4 0,4	4,4 4,4	3 8	3	30 30	53 53

x : Data sheet available on request.

Typ. value at $I_F = 2 \text{ mA}$. Typ. value at $I_F = 0.5 \text{ mA}$.

Telephony applications, approved by British Telecom (output transistor)

type case		C.T.R.		VCEsat	VIORM	ton ^{/t} off (ty	p.)	V(BR)CEO	page
		IF = 10 VCE =	0 mA : 0,5 V	IF = 10 mA IC = 1 mA	kV (a.c.) peak value	$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$			
		min.	max.	max. (V)		t _{on} (μs)	t _{Off} (μs)	min. (V)	
PO40/44A	SOT-90B	0,6 0,25*	1,5	0,5	3,5	7	7	30	277

* Min. value at I $_F$ = 1 mA; V_{CE} = 0,4 V.

 $Note: The\ PO40/44A\ can\ replace\ each\ individual\ type\ PO40A,\ PO41A,\ PO42A,\ PO43A\ and\ PO44A.$

High-speed type, diode/transistor output

type	case	ase C.T.R.		VCEsat	VIORM	t _{on} /t _{off} (ty	p.)	V(BR)CEO	page
		IF = 1 VCC	0 mA = 4,5 V	IF = 10 mA IC = 2 mA	kV (a.c.)	$I_C = 2 \text{ mA}; V_{CC} = 5V;$ $R_L = 100 \Omega$			
		min.	max.	$V_{CC} = 4.5 \text{ V}$ kV (a.c.) peak value	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNR36 SL5505S	SOT-97F SOT-97F	0,2 0,2	4,0	0,4 0,4	3,5 3,5	0,85 0,85	0,85 0,85	18 22	67 ×

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Types in metal encapsulation

Transistor output

type	case	C.T.R		VCEsat	VIORM	t _{on} /t _{off} (ty	· \	V(BR)CEO	page
турс	Cusc	IF = 10 mA		• CESat	VIONIVI		V _{CC} = 5 V;	V(BN)CEO	page
	V _{CE} = 0,4 V			kV (a.c.)	R _L = 100 Ω				
	r	min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX44	SOT-104C	0,3			1,0	5	5	50	299
CNX46	SOT-104C	0,3			1,0	5	5	50	299
CNY50-1	SOT-104B	0,25			1,0	5	5	50	327
CNY50-2	SOT-104B	0,4			1,0	5	5	50	327

Transistor output, GaAIAs emitter diode

type	case	C.T.R.		VCEsat	VIORM	ton/toff (ty	p.)	V(BR)CEO	page
		I _F = 10 mA V _{CE} = 0,4 V		I _F = 50 mA I _C = 2 mA	kV (a.c.)	$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V};$ $R_L = 100 \Omega$			
		min.	max.	max. (V)	peak value	t _{on} (μs)	t _{Off} (μs)	min. (V)	
CNX44A	SOT-104C	0,4			1,0	5	5	60	309
CNX91	SOT-18F	0,3		0,4	0,8	5*	5*	50	319
CNX92	SOT-18F	0,3		0,4	0,8	5*	5*	50	319

^{*} t_r/t_f.

OTHER OPTOELECTRONIC DEVICES

Infrared GaAs and GaAlAs emitter diodes

type	case	λ _p typ. (nm)	lF max. (mA)	IFRM max. (mA)	V _R max. (V)	φ _e typ. (μW)	l _e at (mW/sr)	l _F (mA)	θ½ typ. (o)	t _r /t _f typ. (ns)	page
CQW89A CQW89A-1 CQW89A-2		830 830 830	130 130 130	2500* 2500* 2500*	5 5 5	8000 8000	> 9 > 12 > 15	100 100 100	40 40 40	30/30 30/30 30/30	405 405 405
CQY11B CQY11C	TO-18 TO-18	880 880	30 30	200 A 200 A	2 2	100 50	0,064 1,25	20 20	70 7	30/30 30/30	411 415
CQY49B	TO-18	930	100	1000*	5		> 0,3	50	80	600/350	421
CQY49C	TO-18	930	100	1000*	5		> 3,0	50	15	600/350	421
CQY50	DO-31	930	100	500*	2 2	700	0,180	20	35	600/350	427
CQY52	DO-31	930	100	500*		1500	0,450	20	35	600/350	427
CQY53S	FO-81	690	50		3		1 🗛	10	90		433
CQY58A	SOD-53F	930	50	200*	5	1000	> 2	20	20	3000/3000	437
CQY58A-1	SOD-53F	930	50	200*	5	1000	> 1	20	20	3000/3000	437
CQY58A-2	SOD-53F	930	50	200*	5	1000	3	20	20	3000/3000	437
CQY89A	SOD-63B2	930	130	1000**	5	12 000	> 9	100	40		443
CQY89A-1	SOD-63B2	930	130	1000**	5	12 000	> 12	100	40		443
CQY89A-2	SOD-63B2	930	130	1000**	5	12 000	> 15	100	40		443

^{*} tp = \leq 10 μ s; δ = 0,01 ** tp = 50 μ s; δ = 0,05

 $[\]Delta$ tp = 100 μs; δ = 0,1

[▲] I_V = 1 mcd

emitter	receivers
CQY11B	BPX29
CQY11C	BPX25
CQY49B	BPX29, BPX72
CQY49C	BPX25, BPX72
CQY50/52A	BPX71-203/204, BPW71
CQY58A	BPW22A-1, BPW22A-2
CQY58A-1	BPW22A-1, BPW22A-2
CQY58A-2	BPW22A-1, BPW22A-2
CQW89A	BPW50
CQW89A-1	BPW50
CQW89A-2	BPW50
CQY89A	BPW50
CQY89A-1	BPW50
CQY89A-2	BPW50

Photodiodes

type	case	λ _p typ.	VR max.	lլ at typ.	v _R ;	E _e ;	T _C (K)	I _R at max.	VR	Α	page
		(nm)	(V)	(μA)	(V)	(mW/cm ²)	λ(nm)	(nA)	(V)	(mm²)	
BPW50	SOD-67	930	32	45	5	1	930	30	10	5	347
BPX40	see note	800	18	8*		4,75	2856	500	15	2,1	367
BPX41		800	18	24*		4,75	2856	1000	15	6,3	373
BPX42		800	18	75*		4,75	2856	5000	10	24,8	379
BPX61 BPX61P	SOT-49/3 SOT-49/3	850 850	32 70	70 70	5	4,75	2856	30 1	10	6,75	385

Note: Types BPX40 to BPX42 are unencapsulated. * BPX40,41 and 42 measured in photovoltaic mode, min values.

Phototransistors (NPN)

type	case	VCEO max.	IC max.	IL at	V _{CE} ;	E _e ;	T _C (K)	ICEO at	VCE	page
		(V)	(mA)	(mA)	(V)	(mW/cm^2)	λ(nm)*	(μA)	(V)	
BPW22A-1	SOD-53F	50	25	1,5 to 8	5	1	930*	0,1	30	341
BPW22A-2	SOD-53F	50	25	5 to 25	5	1	930*	0,1	30	341
BPX25	SOT-29/2	50	100	> 4	6	7,75	2856	0,1	24	361
BPX29	SOT-29/1	50	100	> 0,2	6	7,75	2856	0,1	24	361
BPX71	SOT-71A	50	20	0,5 to 15	5	20	2856	0,025	30	391
BPX71-204	SOT-71A	50	20	7 to 15	5	20	2856	0,025	30	391
BPX72	SOT-70A	50	25	0,5-3	5	4,75	2856	0,1	20	397
BPX72D	SOT-70A	50	25	0,85-3	5	4,75	2856	0,1	20	397
BPX72E	SOT-70A	50	25	1,4-3	5	4,75	2856	0,1	20	397
BPX72F	SOT-70A	50	25	2,4-5	5	4,75	2856	0,1	20	397
hoto-Darling	ton transistor									
BPW71	SOT-71A	30	100	> 15	5	1	930*	0,1	10	353

DFW/I	301-7
!	
•	

BPX72F	SOT-70A	50	25	2,4-5	5	4,75	2856	0,1	20	397
Photo-Darl	ington transistor									
BPW71	SOT-71A	30	100	> 15	5	1	930*	0,1	10	353

Lasers and fibre-optic components

Emitters

type	description	page
CQF24	GaAlAs high intensity LED. Hermetic TO-46 header with microlens. Radiant power coupled in fibre of 200 μ m core diameter is 400 μ W at 830 nm.	457
516CQF-B	GaAlAs multi-longitudinal mode diode laser coupled to a 50/125 μ m graded index fibre; radiant output power 3 mW at 850 nm. Options also available for 820 and 870 nm.	487
502CQF	Buried heterostructure InGaAsP laser diode emitting at 1,3 μ m and coupled to a 50/125 μ m graded index fibre. Built in SOT-191 together with a fast responding monitor diode.	475
503CQF	Buried heterostructure InGaAsP laser diode coupled to a single mode fibre pigtail; radiant output power 1,5 mW at 1,3 μ m.	479
CQL10A	AlGaAs double heterostructure laser with photo p-i-n diode optically coupled to the rear facet; radiant output power 5 mW at 820 nm.	463
504CQL	AlGaAs double heterostructure visible laser diode with photo p-i-n diode optically coupled to the rear facet; output power 5 mW at 780 nm.	483
CQL13A	Collimator pen consisting of lens system and laser device with output power 2 mW.	467
CQL16	Collimator pen consisting of lens system and laser device with output power 2 mW.	471

Receivers

ı	BPF24	Si photo p-i-n diode in hermetic sealed TO-46 header with microlens.	453
		Responsivity 0,4 A/W.	

ı	lnf.	rai	red	92	ne	^	rc
		a	eu	26	115	u	13

type	case	number of elements	element dimensions mm	spectral response μm	responsivity typ. V/W	N.E.P. typ. W/Hz½	page
RPY97	SOT-49H	2	2 x 1	6,5 to 14	(10 µm, 10) 150	(10 μm, 10,1) 1,5 x 10 ⁻⁹	507
RPY100	SOT-49H	1	2 x 1	6 to 15	(10 µm, 10) 150	(10 μm, 10,1) 2,5 x 10 ⁻⁹	517
RPY101	SOT-49H	1	2 x 1,5	6 to 15	(10 μm, 10) 150	(10 μm, 10,1) 3,8 x 10 ⁻⁹	527
RPY102	SOT-49H	1	2 x 2	6 to 15	(10 µm, 10) 75	(10 μm, 10,1) 5 × 10 ⁻⁹	537
RPY103	SOT-49H	2	2 x 1	6 to 15	(10 µm, 10) 150	(10 μm, 10,1) 2,2 x 10 ⁻⁹	547
RPY107	SOT-49H	1	2 x 1	1 to 15	(500 K, 10) 130	(500 K, 10,1) 3,0 x 10 ⁻⁹	557
RPY109	SOT-49H	1	2 x 2	1 to 15	(500 K, 10) 65	(500 K, 10,1) 6 x 10 ⁻⁹	567
P2105	SOT-49G	1	2 x 2	1 to 25	(500 K, 10) 90	(500 K, 10.1) 1.4 x 10 ⁻⁹	577

Fresnel lens

A low cost Fresnel lens array for use with sensors, suitable for general purpose movement sensing applications. It is designed to provide high sensitivity, long range monitoring up to at least 12 m, with 90° volumetric coverage.

Lens specification		page
Focal length	30,5 mm	583
Nominal coverage	12 m x 90 °	
Number of monitored zones	A = 8 B = 4 C = 3	
Nominal average transmission	50 %	
Material	polyethylene	



TYPE NUMBER SURVEY



TYPE NUMBER SURVEY

In this alphanumeric list we present all optoelectronic devices mentioned in this handbook

DDE04	DI	page
BPF24	Photodiode for fibre-optic transmission, TO-46	453
BPW22A	Photosensitive transistor, SOD-53F	341
BPW50	Photosensitive PIN diode for remote control, SOD-67	347
BPW71	Photo-Darlington transistor, SOT-71	353
BPX25	Phototransistor with lens, IR remote control, SOT-29/2	361
BPX29	Phototransistor with plane window, IR remote control, SOT-29/1	361
BPX40	Photodiode, sensitivity 14 nA/lx, unencapsulated	367
BPX41	Photodiode, sensitivity 40 nA/lx, unencapsulated	373
BPX42	Photodiode, sensitivity 150 nA/lx, unencapsulated	379
BPX61	Photodiode, sensitivity, 35 μ A, SOT-49	385
BPX61P	Photodiode, sensitivity, 35 μ A, SOT-49	385
BPX71	Phototransistor with glass lens, SOT-71A (D0-31)	391
BPX72	Phototransistor with plastic lens, SOT-70A	397
CNG35	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	53
CNG36	Optocoupler, 4,4 kV, C.T.R. > 0,8, SOT-90B	53
CNR36	Optocoupler, 4,4 kV, $I_{ m OL}$ $>$ 2 mA, SOT-97F	67
CNX21	Optocoupler, 10 kV, C.T.R. > 0,2, SOT-211	75
CNX35	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	83
CNX35U	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	99
CNX36	Optocoupler, 4,4 kV, C.T.R. > 0,8, SOT-90B	83
CNX36U	Optocoupler, 4,4 kV, C.T.R. > 0,8, SOT-90B	99
CNX38	Optocoupler, 4,4 kV, C.T.R. > 2,1, SOT-90B	115
CNX38U	Optocoupler, 4,4 kV, C.T.R. < 2,1, SOT-90B	131
CNX39	Optocoupler, 4,4 kV, C.T.R. > 0,6, SOT-90B	83
CNX39U	Optocoupler, 4,4 kV, C.T.R. > 0,6, SOT-90B	99
CNX44	Optocoupler, 1 kV, C.T.R. > 0,3, SOT-104C	299
CNX44A	Optocoupler, 1 kV, SOT-104C	309
CNX46	Optocoupler, 1 kV, C.T.R. > 0,3, SOT-104C	299
CNX48	Optocoupler, 4,4 kV, C.T.R. > 5, SOT-90B	147
CNX48U	Optocoupler, 4,4 kV, C.T.R. > 5, SOT-90B	159
CNX62	Optocoupler, 5,3 kV, C.T.R. > 0,4, SOT-174	171
CNX72	Optocoupler, 5,3 kV, C.T.R. > 0,4, SOT-90B	183
CNX82	Optocoupler, 5,3 kV, C.T.R. > 0,4, SOT-212	195
CNX83	Optocoupler, 5,3 kV, C.T.R. > 0,4, SOT-212	207
CNX91	Optocoupler, 0,8 kV, SOT-18F	319
CNX92	Optocoupler, 0,8 kV, SOT-18F	319
CNY17-1	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	7
CNY17-2	Optocoupler, 4,4 kV, C.T.R. > 0,63, SOT-90B	7
CNY17-3	Optocoupler, 4,4 kV, C.T.R. > 1,0, SOT-90B	7
CNY50	Optocoupler, 1 kV, C.T.R. > 2,5, SOT-104B	327
CNY57	Optocoupler, 4,4 kV, C.T.R. > 0,2, SOT-90B	219
CNY57A	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	219
CNY57AU	Optocoupler, 4,4 kV, C.T.R. > 0,4, SOT-90B	233
CNY57U	Optocoupler, 4,4 kV, C.T.R. > 0,2, SOT-90B	233
CNY62	Optocoupler, 5,3 kV, C.T.R. > 0,25, SOT-91B	247
CNY63	Optocoupler, 4,3 kV, C.T.R. > 0,50, SOT-91B	247
CQF24	LED, IR, for fibre-optic transmissions, SOT-46	457
CQL10A	Laser diode, 5 mW, 820 nm, SOT-148	463
CQL13A	Collimator pen, 2 mW, 820 nm	467
CQL16	Collimator pen, 2 mW, 780 nm	471
		77.1

TYPE NUMBER SURVEY

		page
CQW89A	LED, IR, for remote control, φ 5 mm, SOD-63D2	405
COY11B	LED, IR, for optical coupling, TO-18 with window	411
CQY11C	LED, IR, for optical coupling, TO-18 with lens	415
CQY49B	LED, IR, for optical coupling, TO-18, with window	421
CQY49C	LED, IR, for optical coupling, TO-18 with lens	421
CQY50	LED, IR, for optical coupling, $\phi = 160$ mW, modified DO-34	427
CQY52	LED, IR, for optical coupling, ϕ = 400 mW, modified DO-34	427
CQY53S	LED, IR, for optical coupling, FO-81	433
CQY58A	LED, IR, for optical coupling, SOD-53F	437
CQY89A	LED, IR, for remote control, SOD-63B2	443
Fresnel lens	Focal length = 30,5 mm, nominal coverage = 12 m x 900	583
H11A1	Optocoupler, 2,5 kV, C.T.R. > 0,5, SOT-90B	259
H11A2	Optocoupler, 1,5 kV, C.T.R. > 0,2, SOT-90B	259
H11A3	Optocoupler, 2,5 kV, C.T.R. > 0,2, SOT-90B	259
H11A4	Optocoupler, 1,5 kV, C.T.R. > 0,1, SOT-90B	259
H11A5	Optocoupler, 2,82 kV, C.T.R. > 2,82, SOT-90B	5
H11B1	Optocoupler, 2,82 kV, C.T.R. > 5,0, SOT-90B	7
H11B2	Optocoupler, 2,82 kV, C.T.R. > 2,0, SOT-90B	7
H11B3	Optocoupler, 2,82 kV, C.T.R. > 1,0, SOT-90B	7
H11B255	Optocoupler, 2,82 kV, C.T.R. > 1,0, SOT-90B	7
MCA230	Optocoupler, 4,4 kV, C.T.R. > 1,0, SOT-90B	. 8
MCA231	Optocoupler, 4,4 kV, C.T.R. > 2,0, SOT-90B	8
MCA255	Optocoupler, 4,4 kV, C.T.R. > 1,0, SOT-90B	8
MCT2	Optocoupler, 4,4 kV, C.T.R. > 0,2, SOT-90B	265
MCT26	Optocoupler, 4,4 kV, C.T.R. > 0,06, SOT-90B	271
P044/44A	Optocoupler, 1,5 kV, C.T.R. > 0,6, SOT-90B	277
P2105	Single element pyroelectric IR detector, 90 V/W, SOT-49G	577
RPY97	Dual ement pyroelectric IR detector, 150 V/W, SOT-49H	507
RPY100	Single element pyroelectric IR detector, 150 V/W, SOT-49H	517
RPY101	Single element pyroelectric IN detector, 150 V/W, 50 T-4511	527
RPY102	Single element pyroelectric IR detector, 750 V/W, SOT-49H	537
RPY103		547
	Dual element pyroelectric IR detector, 150 V/W, SOT-49H Single element pyroelectric IR detector, 130 V/W, SOT-49H	547 557
RPY107		
RPY109	Single element pyroelectric detector, 65 V/W, SOT-49H	567 9
SL5500	Optocoupler, 2,5 kV, C.T.R. > 0,3, SOT-90B	
SL5501	Optocoupler, 2,5 kV, C.T.R. > 0,15, SOT-90B	9
SL5502R	Optocoupler, 2,5 kV, C.T.R. > 0,20, SOT-211	10
SL5504	Optocoupler, 2,5 kV, C.T.R. > 0,15, SOT-90B	10
SL5511	Optocoupler, 2,5 kV, C.T.R. > 0,25, SOT-90B	10
SL5505S	Optocoupler, 4,4 kV, C.T.R. > 0,2, SOT-97F	11
4N25	Optocoupler, 2,5 kV, C.T.R. > 0,2, SOT-90B	291
4N25A	Optocoupler, 1,775 kV, C.T.R. > 0,2, SOT-90B	291
4N26	Optocoupler, 1,5 kV, C.T.R. > 0,2, SOT-90B	291
4N27	Optocoupler, 1,5 kV, C.T.R. > 0,1, SOT-90B	291
4N28	Optocoupler, 0,5 kV, C.T.R. > 0,1, SOT-90B	291
4N35	Optocoupler, 4,4 kV, C.T.R. > 1,0, SOT-90B	5
4N36	Optocoupler, 2,82 kV, C.T.R. > 1,0, SOT-90B	5
4N37	Optocpupler, 2,82 kV, C.T.R. > 1,0, SOT-90B	5
4N38	Optocoupler, 2,82 kV, C.T.R. > 0,1, SOT-90B	6
4N38A	Optocoupler, 2,82 kV, C.T.R. > 0,1, SOT-90B	6
502CQF	Diode laser with fibre pigtail, 1300 nm, SOT-191	475
503CQF	Diode laser with fibre pigtail, 1300 nm, SOT-184	479
504CQL	Diode laser, 3 mW, 780 nm, SOT-148	483
516CQF-B	Diode laser, 5 mW, 850 nm, SOT-184	487

GENERAL

Safety recommendations
Rating system
Letter symbols
Type designation
Definitions
Current transfer ratio
Switching times
Approvals/recognitions

GENERAL SAFETY RECOMMENDATIONS OPTOELECTRONIC DEVICES



1. GENERAL

When properly used and handled, optoelectronic devices do not constitute a risk to health or environment. Modern high technology materials have been used in the manufacture of these devices to ensure optimum performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the devices are heated to destruction and it is important that the following recommendations are observed.

Care should be taken to ensure that all personnel who may handle, use or dispose of these products are aware of the necessary precautions.

Individual product data sheets will indicate whether any specific hazards are likely to be present.

2. DISPOSAL

These devices should be disposed of in accordance with the relevant legislation; in the United Kingdom disposal should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

3. FIRE

Optoelectronic devices themselves, when used within the specified limits, do not present a fire hazard.

Devices can contain arsenic, beryllium, lead, mercury, selenium, tellurium or similar hazardous materials or compounds, which, if exposed to high temperatures may emit toxic or noxious fumes.

Most packaging materials are flammable and care should be taken in the disposal of such materials, some of which will emit toxic fumes if burned.

4. HANDLING

Care must be exercised with those devices incorporating glass or plastic. If these devices are broken, precautions must be taken against the following hazards that may arise:

Broken glass or ceramic. Protective clothing such as gloves should be worn.

Contamination from toxic materials and vapours. In particular, skin contact and inhalation must be avoided.

Access to live contacts which may be at high potential. Devices must be isolated from the mains supply prior to their removal.

5. BERYLLIUM COMPOUNDS

Beryllium oxide dust is toxic if inhaled or if particles enter a cut or an abrasion. At all times avoid handling beryllium oxide ceramics; if they are touched, the hands must be washed thoroughly with soap and water. Do nothing to beryllium oxide ceramics that may produce dust or fumes.

Care should be taken upon eventual disposal that they are not thrown out with general industrial waste. Users seeking disposal of devices incorporating beryllium oxide ceramics should first take advice from the manufacturer's service department.

This potential hazard is present at all times from receipt to disposal of devices.

OPTOELECTRONIC DEVICES

→ 6. OTHER COMPOUNDS

Other compounds, such as those containing arsenic, indium, lead, lithium, selenium, tantalum, tellurium etc., may be toxic by ingestion or inhalation.

> The above information and recommendations are given in good faith and are in accordance with the best knowledge and opinion available at the date of the compilation of the data sheets.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note

This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note

Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note

The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

RATING SYSTEMS

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.

In all other instances upper-case basic letters shall be used.

Anode terminal

Subscripts

A. a

11, u	THIOGO COLIMINAL
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
С, с	Collector terminal
D, d	Drain terminal
Е, е	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive.
	As third subscript: With a specified resistance between the terminal
	not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
1	As first or second subscript: Source terminal (for FETS only)
S, s {	As second subscript: Non-repetitive (not for FETS)
l	As third subscript: Short circuit between the terminal not mentioned
	and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power
	of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

LETTER SYMBOLS

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)

Example IB

b) instantaneous total values

Example i_B

c) average total values

Example I_{B(AV)}

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example I_{B(RMS)}

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example ib

b) root-mean-square values

Example Ib(rms)

c) peak values

Example I_{bm}

d) average values

Example Ib(av)

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should

be done by the first subscript (conventional current flow from the external

circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes:

To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r

should be used.

Examples: I_F, I_R, i_F, I_{f(rms)}

Subscripts for voltages

 $Transistors: \ If \ it \ is \ necessary \ to \ indicate \ the \ points \ between \ which \ a \ voltage \ is \ measuremath{s\text{--}}$

ured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be emitted.

confusion, the second subscript may be omitted.

Examples:
$$V_{BE}$$
, v_{BE} , v_{be} , V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the

subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples:
$$V_F$$
, V_R , v_F , V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples:
$$V_{CC}$$
, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example: V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number: in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

 $V_{\mbox{\footnotesize{B2-E}}}^{}$ = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

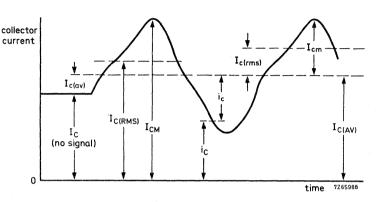
Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the

second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to fourpole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

- a) electrical parameters of external circuits and of circuits in which the device forms only a part;
- b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

$$\begin{array}{lll} F,\,f &=& \text{forward; forward transfer} \\ l,\,i\;(\text{or 1}) &=& \text{input} \\ L,\,l &=& \text{load} \\ O,\,o\;(\text{or 2}) &=& \text{output} \\ R,\,r &=& \text{reverse; reverse transfer} \\ S,\,s &=& \text{source} \\ \\ Examples: \,Z_S,\,h_f,\,h_F \end{array}$$

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

```
Examples: h_{FE} = \text{static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)}
R_{_{\mathbf{E}}} = \text{d.c. value of the external emitter resistance.}
```

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples:
$$h_{fe}$$
 = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$$Z_{e} = R_{e} + jX_{e} = small-signal value of the external impedance$$

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples:
$$h_{FE}$$
, y_{RE} , h_{fe}

LETTER SYMBOLS

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

$$\begin{array}{c} \text{Examples: h} & \text{(or h}_{11}) \\ & \text{h} & \text{(or h}_{22}) \\ & \text{h} & \text{(or h}_{21}) \\ & \text{h} & \text{(or h}_{12}) \end{array}$$

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples:
$$h_{fe}$$
 (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples:
$$Z_i = R_i + jX_i$$

 $y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re
$$(h_{ib})$$
 etc. for the real part of h_{ib}

Im (h_{ib}) etc. for the imaginary part of h_{ib}

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

- A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
- B. SILICON or other material with band gap of 1,0 to 1,3 eV.
- C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
- R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

- A. DIODE; signal, low power
- B. DIODE; variable capacitance
- C. TRANSISTOR; low power, audio frequency (R_{th j-mb} > 15 K/W)
- D. TRANSISTOR; power, audio frequency (R_{th i-mb} ≤ 15 K/W)
- E. DIODE; tunnel
- F. TRANSISTOR; low power, high frequency (Rth j-mb > 15 K/W)
- G. MULTIPLE OF DISSIMILAR DEVICES MISCELLANEOUS; e.q. oscillator
- H. DIODE; magnetic sensitive
- L. TRANSISTOR; power, high frequency (R_{th i-mb} ≤ 15 K/W)
- N. PHOTO-COUPLER
- P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
- Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
- R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power (R_{th i-mb} > 15 K/W)
- S. TRANSISTOR; low power, switching ($R_{th\ j-mb} > 15\ K/W$)
- T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power (R_{th i-mb} ≤ 15 K/W)
- U. TRANSISTOR; power, switching ($R_{th j-mb} \le 15 \text{ K/W}$)
- X. DIODE: multiplier, e.g. varactor, step recovery
- Y. DIODE; rectifying, booster
- Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

TYPE DESIGNATION

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.* One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*

This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: ONE LETTER and ONE NUMBER

The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage

- A. 1% (according to IEC 63: series E96)
- 3. 2% (according to IEC 63: series E48)
- C. 5% (according to IEC 63: series E24)
- D. 10% (according to IEC 63: series E12)
- E. 20% (according to IEC 63: series E6)

The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.

The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: ONE NUMBER

The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R . The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: ONE NUMBER

The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

- 4. RADIATION DETECTORS: *ONE NUMBER*, preceded by a hyphen (–)
 The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.
- 5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER*, preceded by a stroke (/).

The NUMBER indicates how many basic devices are assembled into the array.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

DEFINITIONS FOR OPTOELECTRONIC DEVICES ACCORDING TO IEC 306

DEFINITIONS AND UNITS VALID FOR INFRARED RADIATION

Radiant flux, radiant power ϕ , P, (ϕ_P)

This is the power emitted, transferred or received as radiation, i.e. the radiant energy (dQ_e) emitted per second.

$$\phi_e = \frac{dQ_e}{dt}$$
 unit: watt, W

Radiant intensity Ie, I

For a source of given direction, the radiant intensity is the radiant power leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_e = \frac{d\phi_e}{d\Omega}$$
 unit: watt per steradian, W/sr

Irradiance E, (E_e)

At a point on a surface, the irradiance is the radiant power incident on an element of the surface containing the point divided by the area (A) of that element.

$$E = \frac{d\phi_e}{dA}$$
 unit: watt per square metre, W/m²

DEFINITIONS AND UNITS VALID FOR VISIBLE LIGHT

This is radiation capable of stimulating the eye. Exceptions to this definition are made where necessary in the data sheets, e.g. dark and light currents of a phototransistor and light rise time of a near-infrared light emitting diode.

Luminous flux ϕ , (ϕ_V)

The luminous flux $d\phi$ of a source of luminous intensity I_V in an element of solid angle of $d\Omega$, is given by:

$$d\phi = I_v.d\Omega$$
 unit: lumen, lm

Lumen

This is the luminous flux radiating from a point source of uniform luminous intensity of 1 candela, contained within a solid angle of 1 steradian.

$$1 \text{ lm} = 1 \text{ cd.sr}$$

Luminous intensity I_v, (I)

For a source of given direction, the luminous intensity is the luminous flux leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_V = \frac{d\phi_V}{d\Omega}$$
 unit: candela, cd

Candela

This is the luminous intensity in a given direction, of a source emitting monochromatic radiation at a frequency of 540×10^{12} Hz*, the radiant intensity of which, in that direction, being 1/683 W/sr.

* Approximately 555 nm.

GENERAL

Illuminance E_v, (E)

At a point on a surface, the illuminance is the luminous flux incident on an element of the surface containing the point, divided by the area (A) of that element.

$$E_V = \frac{d\phi_V}{dA}$$
 unit: lux, lx

Lux Ix

This is the illumination produced when 1 lumen of flux falls on a surface of area 1 square metre. It will be seen that an illumination of 1 lx is produced on a area of 1 square metre at a distance of 1 metre from a point source of 1 candela.

Distribution temperature T_d

This is the temperature of a black body at which the spectral radiation distribution of the radiator under consideration, in a given wavelength range, is proportional or approximately proportional to the spectral radiation distribution of the black body. If the wavelength range given includes visible radiation, then the distribution temperature corresponds to the colour temperature.

Colour temperature Tc

The colour temperature of a radiator is the temperature of a black body which has the same, or approximately the same, spectral radiation distribution in the visible range as the radiator under consideration.

DEFINITIONS OF ELECTRICAL QUANTITIES

Photocurrent Iph

This is the change in output current from the photocathode due to incident radiation.

Dark current Id

This is the current flowing in a photoelectric device in the absence of illumination.

Dark current equivalent radiation Ed.

This is the incident radiation required to give a d.c. signal output current equal to the dark current.

Quantum efficiency

This is the ratio of the number of emitted photoelectrons to the number of incident photons, Quantum efficiency (Q.E.) at a given wavelength of incident radiation may be calculated as follows:

Q.E. =
$$\frac{\text{constant x S}_k}{\lambda}$$

where S_{k} = spectral sensitivity (A/W) at wavelength λ = wavelength of incident radiation (nm)

constant =
$$\frac{hc}{e}$$
 = 1,24 x 10³ W.nm/A

 $h = Planck's constant (6,6256 \times 10^{-34} js)$

c = velocity of electromagnetic waves in vacuo = 2,997925 x 108 m/s

e = elementary charge = $1,60210 \times 10^{-19}$ coulomb or $4,80298 \times 10^{-19}$ e.s.u.

Saturation voltage V_{CEsat}

This is the lowest operating voltage which causes no change in photocurrent when this voltage is increased with constant radiation.

Saturation current ICEsat

This is the output current of a photosensitive device which is not changed by an increase of either:

- a. the irradiance under constant operating conditions, or,
- b. the operating voltage under constant irradiance.

Thermal resistance

This is the ratio of temperature rise to power dissipation or

$$R_{th j-a} = \frac{T_j - T_{amb}}{P_{tot}}$$

The thermal resistance is also the reciprocal of the derating factor.

Pulsed operation

Under these conditions higher peak power dissipation is possible. In general, the shorter the pulse and lower the frequency, the lower is the temperature that the junction reaches.

By analogy with thermal resistance:

$$Z_{th j-a} = \frac{T_j - T_{amb}}{P_{tot}}$$

DEFINITIONS OF SENSITIVITY

These definitions apply more directly to photocathode sensitivity. For devices in which it is necessary to define the anode (overall) sensitivity, the signal output current should be considered instead of the photocurrent.

Actinity of radiation Z

This is the ratio of the sensitivity to a given radiation to the sensitivity to a reference radiation.

Radiant sensitivity SR

This may be expressed as either:

- a. the ratio of the photocurrent of the device to the incident radiant power, expressed in amperes per watt (A/W), or,
- b. the ratio of the photocurrent of the device to the incident irradiance, expressed in amperes per watt per square metre (A/W/m²).

Absolute spectral sensitivity $s(\lambda)$

This is the radiant sensitivity for monochromatic radiation of a stated wavelength.

Relative spectral sensitivity s $(\lambda)_{rel}$

This is the ratio of the radiant sensitivity at a particular wavelength to the radiant sensitivity at a reference wavelength, usually the wavelength of maximum reponse.

Note

For non-linear detectors, it is necessary to refer to constant photocurrent at all wavelengths.

Luminous sensitivity S₁

This may be expressed as either:

- a. the ratio of the photocurrent of the device to the incident luminous flux, expressed in amperes per lumen (A/Im), or.
- b. the ratio of the photocurrent of the device to the incident illuminance, expressed in amperes per lux (A/Ix).

Dynamic sensitivity SD

Under stated operating conditions, this is the ratio of the variation of the photocurrent of the device to the initiating small variation in the incident radiant or luminous power.

Note

Distinction is made between luminous dynamic sensitivity and radiant sensitivity.

Spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute or relative spectral sensitivity.

Absolute spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute spectral sensitivity.

Relative spectral sensitivity characteristics

This is the relationship between wavelength and the relative spectral sensitivity.

Quantum efficiency characteristic

This is the relationship, usually shown in graphical form, between the wavelength and the quantum efficiency.

DEFINITIONS OF TIME QUANTITIES

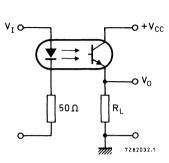
Rise time tr

This is the time required for the photocurrent to rise from a stated low percentage to a stated higher percentage of the maximum value when a steady state of radiation is instantaneously applied. It is usual to consider the 10% and 90% levels (see Figs 1 and 2).

Fall time tf

This is the time required for the photocurrent to fall from a stated high percentage to a stated lower percentage of the maximum value when the steady state of radiation is instantaneously removed.

It is usual to consider the 90% and 10% levels (see Figs 1 and 2).



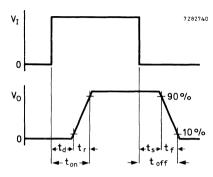


Fig. 1 Switching circuit.

Fig. 2 Waveforms.

DEFINITIONS AND UNITS OF INFRARED SENSITIVE DEVICES

Emissivity

This is the ratio of the radiant exitance of a thermal radiator to that of a black body radiator at the same temperature.

Absolute refractive index n

This is the ratio of the velocity of light in vacuo to that in a particular medium. For most practical purposes the velocity of light in vacuo can be replaced by that in air.

Detectivity

This is the signal-to-noise ratio per unit radiant power. Thus it is the reciprocal of the N.E.P. Care must be exercised when considering detectivity as this term has also been used in the definitions of D*.

unit: 1/watts (1/W)

D*

This is an independent figure of merit which is defined as the r.m.s. signal-to-noise ratio in a 1 Hz bandwidth per unit r.m.s. incident radiant power per square root of detector area. Unless otherwise stated, it is assumed that the detector field of view is hemispherical (2 π steradian).

unit: cm,/Hz/W

Wave number

This is the reciprocal of the wavelength in centimetres. ($\frac{1}{\lambda}$)

N.E.P. (Noise Equivalent Power)

This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth V/\sqrt{Hz} .

unit: W/√Hz

Responsivity

This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

unit: V/W

GENERAL

Noise equivalent irradiation

This is the value of incident radiation which, when modulated in a stated manner, produces a signal output power equal to the noise power, both of which are in a stated bandwidth.

Radiance La

This is the radiant intensity (I_e) at a point on a surface and in a given direction, of an element of that surface, divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: watt per steradian square metre, W/sr.m²

Radiant exitance (radiant emittance) Me

At a point on a surface, this is the radiant power leaving an element of that surface, divided by the area of the element.

$$M_e = \frac{d\phi_e}{dA}$$
 unit: watt per square metre, W/m²

Luminous exitance (luminous emittance) M_V

At a point on a surface, this is the luminous flux leaving an element of that surface, divided by the area of that element.

$$M_V = \frac{d\phi_V}{dA}$$
 unit: lumen per square metre, lm/m²

Luminance L_V

This is the luminous intensity (I_V) at a point on a surface and in a given direction, of an element of that surface divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: candela per square metre, cd/m²

Steradian sr (see Fig. 3)

This is the solid angle subtended at the centre of a sphere by an element of the surface area equal to the square of the radius of the sphere. There are, therefore, 4π steradians in a complete sphere.

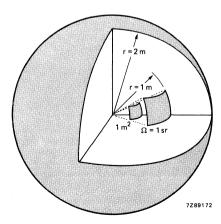


Fig. 3.

ADDITIONAL DEFINITIONS FOR OPTOCOUPLERS

Input current I;

Current flowing in the input terminals corresponding, in most cases, to the forward current of the LED (I_F).

Output current In

Current flowing in the output terminals corresponding, in most cases, to the collector current of the transistor.

Transfer matrix

The output expressed as a function of the input is

$$V_0 = AV_i + Bi_i$$

 $i_0 = CV_i + Di_i$

which can be expressed as the matrix

$$M = \begin{pmatrix} V_o \\ i_o \end{pmatrix} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} \begin{pmatrix} v_i \\ i_i \end{pmatrix}$$

the general transfer matrix.

Transfer ratio τ

The transfer ratio is derived from

$$\begin{aligned} &V_O/V_i = A \\ &i_O/V_i = C \\ &V_O \approx Bi_i \\ &i_O \approx Di_i \end{aligned}$$
 and
$$\tau = i_i/i_e \text{ for a given } V_O$$

The ratio is usually expressed as a factor.

Isolation voltage V_{IORM}

The maximum voltage that can be applied between the short-circuited input terminals and the short-circuited output terminals. The type of voltage must be specified, i.e. direct, alternating or repetitive peak.

Repetitive peak voltage rating indicates the resistance to transients. If exceeded, this can result in irreversible damage to the device.

Working voltage V2

The maximum voltage that may be applied continuously between the input and the output of the device under normal operating conditions without altering its characteristics.

Collector cut-off current (dark) ICFW

The collector cut-off (dark) current at a defined V_{CC} and a defined working voltage V_z applied between the short-circuited leads of the IR diode and the emitter of the transistor.

Input and output capacitance Cio

The capacitance between the input terminals and the output terminals.

Insulation resistance Rio

The resistance between the input terminals and the output terminals.

Common-mode rejection ratio CMRR

The ratio between a common-mode voltage and the output voltage expressed in dB. The coupling, mainly capacitive, reduces the value.

 $CMRR = 20 \log \frac{V_o}{V_{cm}}$

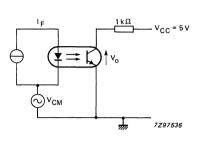


Fig. 1.

Linearity

Linearity depends on both the emitter and receiver characteristics. The characteristics of the transistor are shown in Fig. 2, those of the diode are shown in Fig. 3.

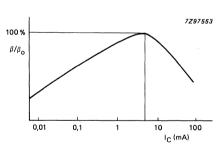


Fig. 2.

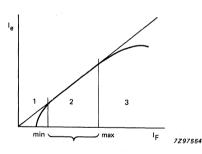


Fig. 3.

Zone 1 shows the non-linearity caused by the non-radiative current of the LED being greater than the radiative current. Non-linearity in zone 3 is caused by saturation.

DEFINITIONS OF TIME QUANTITIES

Switching times

Switching times are defined for a square input pulse, Vi.

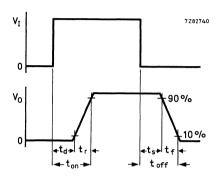


Fig. 4 Waveforms.

Delay time td

The time elapsing between the start of the pulse and the moment when the output signal reaches 10% of its maximum value

Rise time tr

The time elapsing between the moment when the output signal is 10% of its maximum value and the moment when it reaches 90% of this value.

Turn-on time ton

The time elapsing between the start of the pulse and the moment when the corresponding output signal is 90% of its maximum value.

$$t_{on} = t_d + t_r$$

Storage time ts

The time elapsing between the end of the input pulse and the moment when the corresponding output signal drops by 10% of its maximum value (or the time when it is still 90%).

Fall time tf

The time elapsing between the moment when the output signal is still 90% of its maximum value and the moment when it is no more than 10%.

Turn-off time toff

The time elapsing between the end of the input pulse and the moment when the corresponding output signal falls to 10% of its maximum value.

$$t_{off} = t_s + t_f$$

Propagation delay times

High-Low propagation delay time tpHL

for TTL: The time between the specified reference points on the input and output waveforms with

the output changing from the defined HIGH level to the defined LOW level.

for CMOS: The time between the specified reference points, normally the 50% points on the input

and output waveforms, with the output changing from the defined HIGH level to the

defined LOW level.

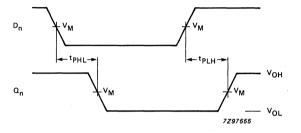


Fig. 5 TTL.

Low-High propagation delay time tpl H

for TTL: The time between the specified reference points on the input and output waveforms with

the output changing from the defined LOW level to the defined HIGH level.

for CMOS: The time between the specified reference points, normally the 50% points on the input

and output waveforms, with the output changing from the defined LOW level to the defined HIGH level.

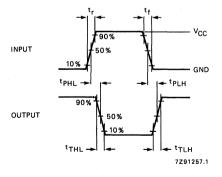


Fig. 6 CMOS.

PARAMETERS INFLUENCING THE CURRENT TRANSFER RATIO OF AN OPTOCOUPLER

Our optocouplers are frequently specified at $V_{CE} = 0.4 \text{ V}$, $I_F = 10 \text{ mA}$. Many other suppliers specify the transfer ratio at $V_{CE} = 5 \text{ V}$ or even 10 V when, in fact, the C.T.R. can be much higher. In comparing Philips optocouplers with alternative types a correction factor should be applied.

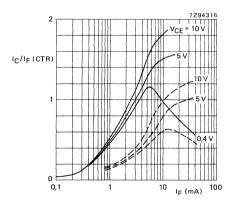
The current transfer ratio $I_{\text{C}}/I_{\text{F}}$ (CTR) of an optocoupler depends mainly on the biasing conditions of the LED and phototransistor.

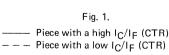
The curve of Fig. 1 shows a typical example of the I_C/I_F (CTR) at different I_F and V_{CE} values. The I_C/I_F (CTR) is normalized at 1 for I_F = 10 mA, V_{CE} = 0,4 V and for a high I_C/I_F (CTR).

If the base of the device is accessible, it is possible to limit the I_C/I_F (CTR) by wiring a resistance RBE between the base and emitter. This resistance provides a threshold and thus limits the noise at the optocoupler output.

The curve of Fig. 2 shows three zones:

- 1. The phototransistor is OFF and only the current of the collector-base photodiode is available.
- 2. The phototransistor is just at the limit of conduction.
- 3. The phototransistor is ON and the collector current is no longer dependent on RBF.





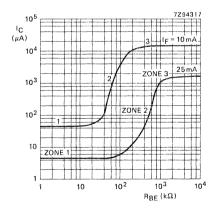


Fig. 2 V_{CC} = 5 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLER SWITCHING TIMES

The curves published for each optocoupler type refer to the non-saturating mode. It is possible to choose the collector current and the load resistance R_{\perp} corresponding to the desired switching times.

In the saturation mode, the switching times depend on the forward current I_F, the load resistance R_L and an extra resistance R_{BE} which may be connected between the base and emitter of the phototransistor. This greatly improves the speed of the circuit.

Fig. 1 shows the typical switching times as a function of R_L without R_{BE}.

Fig. 2 shows these times as a function of I_F without R_{BE} and with R_{BE} = 100 k Ω .

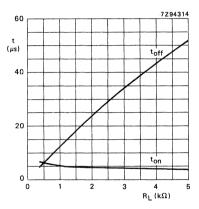


Fig. 1 $V_{CC} = 5 \text{ V; I}_F = 10 \text{ mA}.$

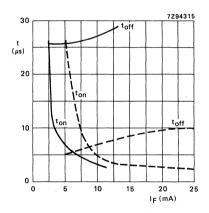


Fig. 2 V_{CC} = 5 V; R_L = 2,5 kΩ.
———— R_{BE} =
$$\infty$$

———— R_{BE} = 100 kΩ

APPROVALS/RECOGNITIONS

See data sheets for file and certificate numbers

	UL	VDE 0883	VDE 0804	VDE 0860	others
CNG35					
CNG36				ļ	
CNR36					
CNX21					
CNX35					
CNX35U	×	×	×	×	
CNX36					
CNX36U	×	×	×	×	
CNX38					
CNX38U	×	×	×	×	
CNX39					
CNX39U	×	x	x	×	
CNX44					
CNX44A					
CNX46					
CNX48	İ				
CNX48U	×	×	×	×	
CNX62	×	x	x	x	(see note 1)
CNX72	×	×	×	×	
CNX82	×	×	×	×	(see note 2)
CNX83	pending	pending	pending	pending	
CNX91					
CNX92					
CNY17-1	pending	×	×	×	
CNY17-2	pending	×	×	×	
CNY17-3	pending	×	×	x	
CNY50					
CNY57					
CNY57A					
CNY57AU	×	×	×	×	
CNY57U	×	×	×	×	
CNY62					
CNY63					
H11A1	×	×			
H11A2	×	×			
H11A3	x	×	1		
H11A4	×	×			
H11A5	pending	×			
H11B1	pending	x			
H11B2	pending	×			
H11B3	pending	x			

GENERAL

MCA230	-	•	_			· .
MCA230		UL		1		others
MCA230	H11B255	pending	×			
MCA255	MCA230		×			
MCT2	MCA231	pending	×			
MCT26	MCA255	pending	×	į.		
British Telecom (see note 3) French CNET CNET approval pending MCT2	×	×	×	×	The state of the s	
French CNET	MCT26	×	×	×	×	
SL5501 SL5502R SL5504 French CNET CNET approval pending CNET approval	PO40/44A					British Telecom (see note 3)
SL5502R SL5504 French CNET CNET CNET CNET Angle	SL5500					French CNET
SL5504 SL5511 SL5505S 4N25	SL5501			1		French CNET
SL5511 SL5505S 4N25	SL5502R					French CNET
SL5505S 4N25	SL5504					French CNET
4N25	SL5511					French CNET
4N25A	SL5505S	-		i		French CNET
4N26	4N25	×	×			CNET approval pending
4N27	4N25A	×	x .			
4N28 x x x 4N35 pending x x x x x 4N36 pending x x x x 4N37 pending x 4N38 pending x	4N26	x	×			
4N35 pending x x x x 4N36 pending x 4N37 pending x 4N38 pending x	4N27	×	×	1	1	
4N36 pending x 4N37 pending x 4N38 pending x	4N28	×	×			
4N37 pending x 4N38 pending x	4N35	pending	×	×	×	
4N38 pending x	4N36	pending	×		1	
	4N37	pending	×			
4N38A pending x	4N38	pending	×			
	4N38A	pending	×			

Note 1 Application approval based on video game G2700/... by Nordic countries. Approved by BSI for standard BS415–1979.

Note 2 Approvals for Nordic countries and BSI pending.

Note 3 This type PO40/44A can replace each individual type PO40A, PO41A, PO42A, PO43A and PO44A.

SECTION A1

Optocouplers in a plastic encapsulation

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

GaAlAs OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAlAs diode and a silicon n-p-n phototransistor with accessible base in a SOT-90B envelope, designed for low input current and long life operation.

The application of an IR emitting diode, based on a special GaAlAs (intrinsic) process results in a perfect linearity at Jow input currents and a very low degradation during the device's operating life.

QUICK REFERENCE DATA

Diode				
Forward current (d.c.)		۱F	max.	100 mA
Transistor				
Collector-emitter voltage (open base)		VCEO	max.	30 V
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.)				
$I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	CNG35	IC/IF	min.	0,4
	CNG36	IC/IF	min.	0,8
$I_F = 500 \mu\text{A}; V_{CE} = 0.4 \text{V}$	CNG35	IC/IE	min.	0,1
	CNG36	IC/IF	min.	0,2
Leakage current under working voltage				
2,5 kV d.c. value; V _{CC} = 10 V		ICEW	max.	200 nA
				4,4 kV(d.c.)
Isolation voltage		VIORM	min.	3,12 kV(r.m.s.)

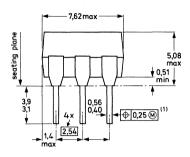
MECHANICAL DATA

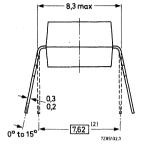
SOT-90B (see Fig. 1).

MECHANICAL DATA

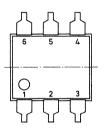
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- (M) Maximum Material Condition.

۷p

 Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.

max.

5 V

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Continuous reverse voltage

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	* n	mux.	• •
Forward current			
d.c.	۱Ę	max.	100 mA
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$	^I FRM	max.	2,5 A
Total power dissipation			
up to T _{amb} = 25 °C	P_{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	30 V
Collector-base voltage (open emitter)	V _{CBO}	max.	70 V
Emitter-collector voltage (open base)	V _{ECO}	max.	7 V
Collector current	IC	max.	100 mA
Total power dissipation			
up to T _{amb} = 25 °C	Ptot	max.	200 mW

Optocoupler			
Storage temperature	T_{stq}	–55 t	o +150 °C
Junction temperature	T _i	max.	125 °C
Lead soldering temperature	j		
up to the seating plane; $t_{\mbox{sld}} < 10$	s T _{sld}	max.	260 °C
THERMAL RESISTANCE			
From junction to ambient in free air	r		
diode	R _{th j-a}	max.	500 K/W
transistor	R _{th} j-a	max.	500 K/W
From junction to ambient, device mounted on a printed circuit boa	rd		
diode	R _{th i-a}	max.	400 K/W
transistor	R _{th} j-a	max.	400 K/W
ISOLATION RELATED VALUES			
External air gap (clearance)			
input terminals to output termina	L(IO1)	min.	7,2 mm
External tracking path (creepage dis			7.0
input terminals to output termina	L(102)	min.	7,0 mm
Tracking resistance (KB-value)		KB-100	J/A
CHARACTERISTICS			
T _j = 25 °C unless otherwise specifie	d		
Diode			
Forward voltage			1 45 17
I _F = 10 mA	V _F	typ. max.	1,45 V 1,75 V
Reverse current			
V _R = 5 V	I _R	max.	10 μΑ
Transistor			
Collector-emitter breakdown voltage	e		
open base; I _C = 1 mA	V(BR)C	EO min.	30 V
Collector-base breakdown voltage			
open emitter; $I_C = 0.1 \text{ mA}$	V(BR)C	BO min.	70 V
Emitter-collector breakdown voltage			7 V
open base; IE = 0,1 mA Collector cut-off current (dark)	V(BR)E	CO min.	, v
VCE = 10 V	ICEO	typ.	2 nA
V _{CE} = 10 V; T _{amb} = 70 °C	ICEO	max. max.	50 nA 10 μA
V _{CB} = 10 V, Tamb = 70 - 3	ICBO	max.	10 μA 20 nA
	350		

CNG35 CNG36

Optocoupler					
Collector current					
at T _{amb} = 0 °C to 70 °C					
$V_F = 0.8 V; V_{CE} = 15 V$		ICE(L)	max.	15	
$I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$		ICE(L)	min.	250	μΑ
Collector-emitter saturation voltage			typ.	0.15	V
I _F = 10 mA; I _C = 2 mA	CNG35	VCEsat	max.	0,4	
			typ.	0,19	V
$I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	CNG36	VCEsat	max.	0,4	
Output capacitance					
V _{CB} = 10 V; f = 1 MHz		C_bc	typ.	4,5	pF
Collector current at					
working voltage $V_W = 2.5 \text{ kV}$;					
(d.c. value) see notes 1 and 2					
$V_{CC} = 10 \text{ V}; T_j = 25 \text{ °C}$		CEW	max.	200	
$V_{CC} = 10 \text{ V; T}_{j} = 70 \text{ °C}$		ICEW	max.	100	μΑ
Isolation voltage		.,		4,4	kV(d.c.)
(see note 3)		VIORM	min.	3,12	kV(r.m.s.)
Capacitance between input and output					
V = 0; $f = 1 MHz$		Cio	typ.	0,6	pF .
Insulation resistance between input and output			min.	10 ¹⁰	0
$\pm V_{IO} = 1 \text{ kV}$		rio	typ.	10 ^{1 2}	
Switching times (see figures 3 and 4)			٠, ۵.		·
$I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_1 = 100 \Omega$					
Turn-on time	ONICAE	ton	typ.	3	μs
Turn-off time	CNG35	toff	typ.	3	μs
$I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$					
Turn-on time	CNG35	ton	typ.	12	•
Turn-off time	CNGOO	toff	typ.	12	μs
$I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$					
Turn-on time	CNG36	ton	typ.		μs
Turn-off time		toff	typ.	6	μs
$I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$, $R_L = 1 \text{ k}\Omega$			****	20	2
Turn off time	CNG36	t _{on}	typ.	20	

typ.

toff

18 μs

Turn-off time

			CNG35	CNG36	
D.C. current transfer ratio (C.T.R.)		min.	0,4	0,8	
$I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	IC/IF	typ.	0,7	1,0	
		max.	1,6		
$I_F = 2 \text{ mA; } V_{CE} = 0.4 \text{ V}$	IC/IF	typ.	0,9	1,4	
I= 05 = A: V = 0.4 V	1 - 0 -	min.	0,1	0,2	
$I_F = 0.5 \text{ mA}; V_{CE} = 0.4 \text{ V}$	IC/IF	tvp.	0.5	0.8	

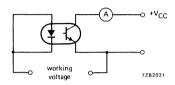


Fig. 2.

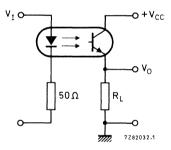
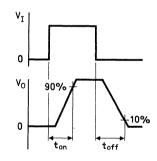


Fig. 3 Switching circuit.



7Z67238.2 Fig. 4 Waveforms.

Notes.

- This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the emitter and the two shorted diode leads.
- 2. As quality assurance (on a sample basis), these parameters are covered by a 1000 hour reliability test.
- 3. Tested on sample basis. The input diode leads are shorted together and all the transistor leads shorted together, then a test voltage of 4,4 kV (d.c.) is applied for 1 min.

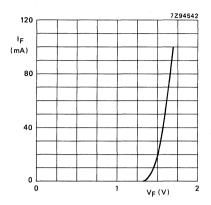


Fig. 5 T_{amb} = 25 °C; typical values.

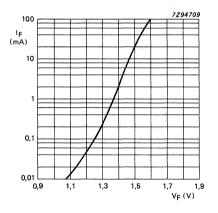


Fig. 7 T_{amb} = 25 °C; typical values.

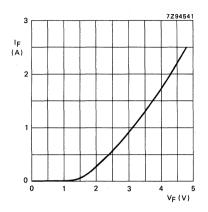


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

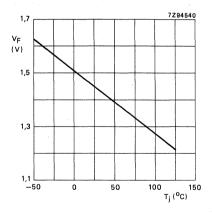


Fig. 8 IF = 10 mA; typical values.

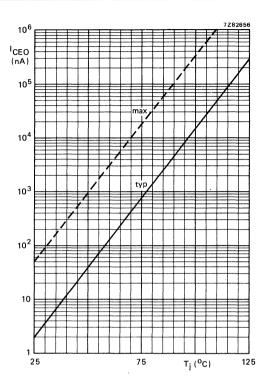


Fig. 9 $I_F = 0$; $V_{CE} = 10 \text{ V}$.

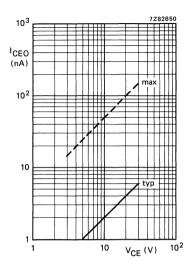


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

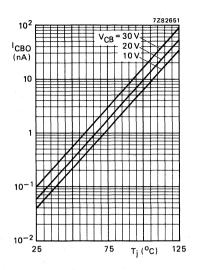


Fig. 11 Typical values.

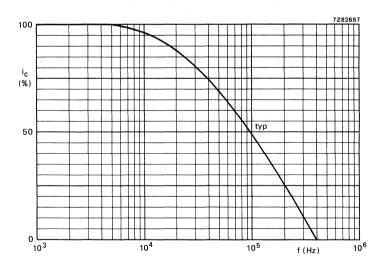


Fig. 12 I $_B$ = 0; I $_C$ = 2 mA; V $_{CC}$ = 5 V; R $_L$ = 1 k Ω ; T $_{amb}$ = 25 °C.

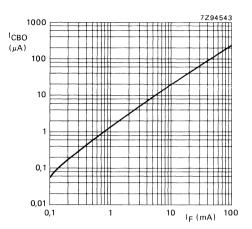


Fig. 13 V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

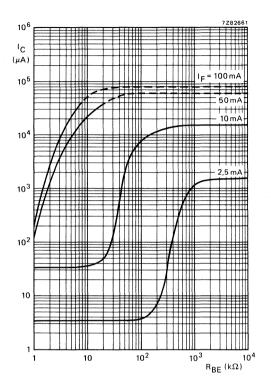


Fig. 14 I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

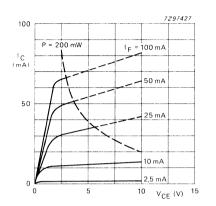


Fig. 15 T_{amb} = 25 °C, typical values; CNG35.

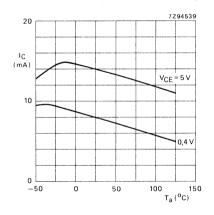


Fig. 17 $I_F = 10 \text{ mA}$; typical values; CNG35.

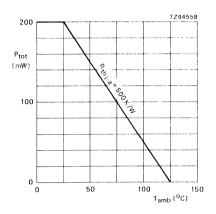


Fig. 16.

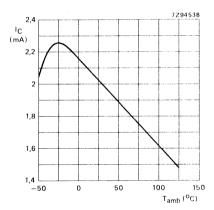


Fig. 18 $I_F = 2$ mA; $V_{CE} = 0.4$ V; typical values; CNG35.

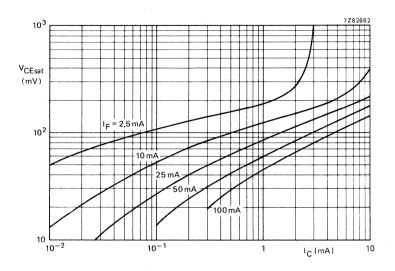


Fig. 19 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

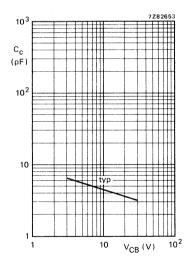


Fig. 20 f = 1 MHz; $T_{amb} = 25$ °C.

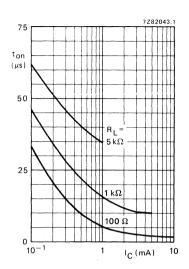


Fig. 21 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typi al values. (See also Fig. 23); CNG35.

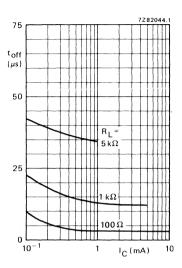
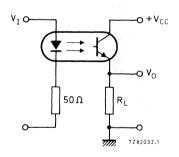


Fig. 22 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 23); CNG35.



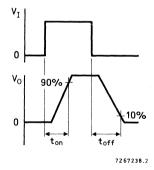


Fig. 23 Switching circuit and waveforms.



DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

HIGH-SPEED OPTOCOUPLER

The CNR36 is a fast switching optocoupler consisting of a GaAlAs light emitting diode which is optically coupled to an integrated silicon photodetector in an 8-pin dual-in-line (DIL) envelope SOT-97F. It is suitable for use with TTL integrated circuits.

Features

- short propagation delay times
- low saturation voltage
- high isolation voltage of 2,5 kV (r.m.s.) and 3,5 kV (d.c.)
- working voltage of 2.5 kV (d.c.)
- high transient immunity

QUICK REFERENCE DATA

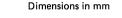
Diode				
Continuous reverse voltage	VR	max.	5 V	
Forward current d.c. peak value; $t_{on} = 1 \mu s$	lFM	max. max.	100 mA 1 A	\
Transistor				
Collector-emitter breakdown voltage $I_C = 10 \text{ mA}$	V(BR)CEO	min.	18 V	
Optocoupler				
Output current $I_F = 10 \text{ mA; } V_{CC} = 4.5 \text{ V; } V_O = 0.4 \text{ V}$	loL	min. typ.	2 mA 4 mA	
Logic low output voltage $I_F = 10 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$; $I_0 = 2 \text{ mA}$	V _{OL}	typ. max.	0,2 V 0,4 V	
Propagation delay time	^t PHL ^t PLH	max. max.	0,8 μs 0,8 μs	
Common mode transient immunity	±CM	min.	1 kV/	/μs
Isolation voltage	VIORM	min.	3,5 kV 2,5 kV	

MECHANICAL DATA

SOT-97F (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT-97F.

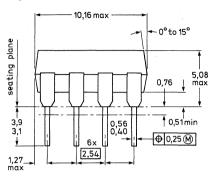


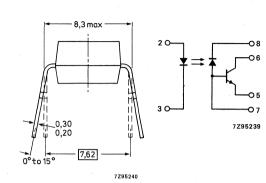
5 V

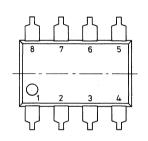
100 mW

max.

max.







- Positional accuracy.
- (M) Maximum Material Condition.
- (1) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from the nominal by 0,25 mm.
 - (2) When the leads are parallel, the tips remain in position for automatic insertion.

٧ĸ

Ptot

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage

Forward current

1 Of Ward Current			
d.c.	۱F	max.	100 mA
(peak value); $t_p = 1 \mu s$	IFM	max.	1 A
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	250 mW
Transistor			
Emitter-base voltage	VEBO	max.	5 V
Collector-emitter breakdown voltage			
IC = 10 mA	V(BR)CEO	min.	18 V
Emitter-base breakdown voltage	V _{(BR)EBO}	min.	5 V
Collector current (d.c.)	IC	max.	10 mA

Total power dissipation up to Tamb = 85 °C

Optocoupler				
Storage temperature	T _{stq}	-55 t	o +150	оС
Operating junction temperature	T _i	max.	125	oC
Lead soldering temperature up to the seating plane; $t_{\rm sld}$ $<$ 10 s	T _{sld}	max.	260	оС
THERMAL RESISTANCE				
From junction to ambient in free air diode transistor	R _{th j-a} R _{th j-a}	=		K/W K/W
From junction to ambient, with the device mounted on a printed circuit board diode	•	=	400	K/W
transistor	R _{th j-a} R _{th j-a}	=		K/W
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage I _F = 10 mA	VF	typ. max.	1,65 1,9	
Reverse current V _R = 5 V	IR	max.	10	μΑ
Transistor (diode: $I_F = 0$)				
Collector-emitter breakdown voltage at $I_C = 10 \text{ mA}$	V _(BR) CEO	min.	18	V
Collector-base breakdown voltage* at $I_C = 100 \mu A$	V _(BR) CBh	min.	30	V
Emitter-base breakdown voltage at $I_E = 0.1$ mA	V(BR)EBO	min.	5	V
Logic high output current $I_F = 0$; $V_O = V_{CC} = 5,5 \text{ V}$	ГОН	typ. max.	5 500	nA nA
Logic high output current IF = 0; V _O = V _{CC} = 15V	ГОН	max.	100	μΑ
Logic high supply current $I_F = 0$; $I_O = 0$; $V_{CC} = 15V$	Іссн	max.	1	μΑ
Logic low supply current $I_F = 10 \text{ mA}$; $V_{CC} = 15 \text{ V}$	ICCL	typ.	20	μΑ
Optocoupler				
Output current I _F = 10 mA; V_{CC} = 4,5 V; V_{o} = 0,4 V	lOL	min. typ.	_	mA mA

^{*} Cathode connected to collector

CNR36

Logic low output voltage $I_F = 10 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$; $I_O = 2 \text{ mA}$

Capacitance between input and output f = 1 MHz

Isolation voltage (note 2)

Insulation resistance between input and output $\pm V_{1O} = 1 \text{ kV}$

Switching times (see Figs 2 and 3)

 $I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 2.5$ kΩ

Propagation delay time to logic low at output

Propagation delay time to logic high at output

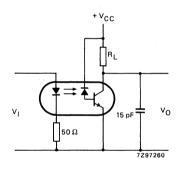


Fig. 2 Switching circuit.

Switching times (see Figs 4 and 5) $I_{Con} = 2$ mA; $V_{CC} = 5$ V; $R_{L} = 100$ Ω $T_{urn-on time}$ $T_{urn-off time}$

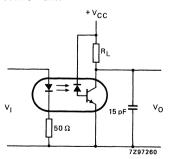
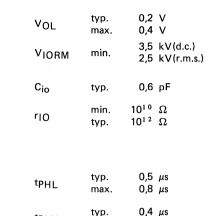
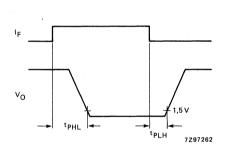


Fig. 4 Switching circuit.





max.

0,8 µs

^tPLH

Fig. 3 Waveforms.

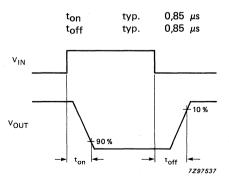


Fig. 5 Waveforms.

 $-1 \text{ kV/}\mu\text{s}$

1 $kV/\mu s$

100 μΑ

Transient immunity

 $V_{CC} = 5 \text{ V}; V_{CM} = 10 \text{ Vpp}; R_L = 2.5 \text{ k}\Omega$

Common mode transient immunity at logic low IF = 10 mA

Common mode transient immunity at logic high

IF = 0

Logic high output current (note 1, see Fig. 6)

 $V_{CC} = 5.5 \text{ V}$; working voltage (d.c.) = 2.5 kV;

 $V_{CC} = 5.5 \text{ V}$; working voltage (d.c.) = 2.5 kV $T_{amb} = 70C$

> +Vcc Vo

Смі

Смн

IOHW

min.

min.

max.

Fig. 6.

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals External tracking path (creepage dist)

L(101) min. 7,2 mm

External tracking path (creepage dist) input terminals to output terminals

L(102) min.

n. 7,0 mm

Tracking resistance (KB-value)

Notes

- This parameter is the working collector-emitter leakage current measured when a high voltage is applied between the emitter and the short circuited diode leads.
- Tested on a sample basis with a voltage of 3500 V (d.c.) or 2,5 kV (r.m.s.) for 1 minute between the shorted input (diode) leads and the shorted output (phototransistor) leads.

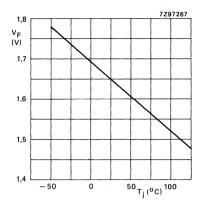


Fig. 7 I_F = 10 mA; typical values.

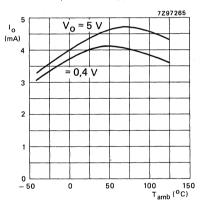


Fig. 9 $V_{CC} = 5 V$; $I_F = 10 \text{ mA}$; typical values.

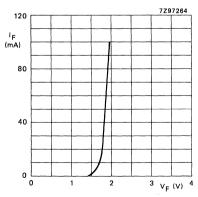


Fig. 11 $T_{amb} = 25$ °C; typical values.

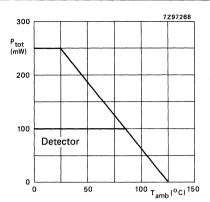


Fig. 8.

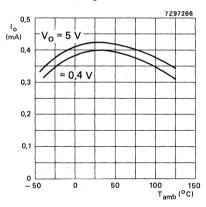


Fig. 10 $V_{CC} = 5 \text{ V}$; IF = 2 mA; typical values.

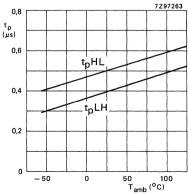


Fig. 12 I_F = 10 mA; V_{CC} = 5 V; R_L = 2,5 k Ω ; typical values.

DEVELOPMENT DATA

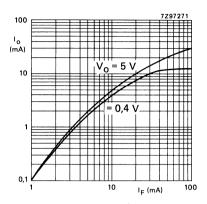


Fig. 13 $V_{CC} = 5 V$; typical values.

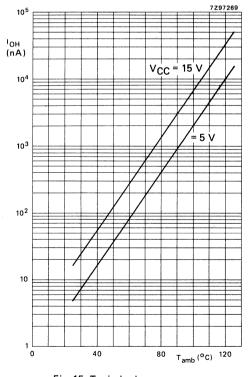


Fig. 15 Typical values.

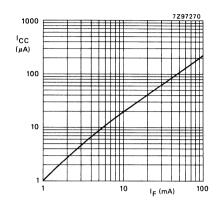


Fig. 14 V_{CC} = 15 V; I_0 = 0; typical values.

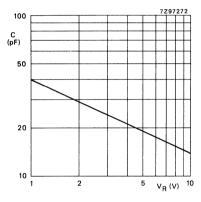


Fig. 16 T_{amb} = 25 °C; typical values. Photodiode capacitance

HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor. The base is not accessible.

Features of this product:

- very high isolation voltage of 10 kV (d.c.).
- working voltage of 10 kV (d.c.).
- high common mode rejection 85 dB

QUICK REFERENCE DATA

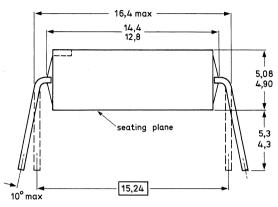
Diode				
Continuous reverse voltage	V_{R}	max.	5	V
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	l _F l _{FRM}	max. max.	3	mA A
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	100	mW
Transistor				
Collector-emitter voltage (open base)	v_{CEO}	max.	30	V
Total power dissipation up to $T_{amb} = 25 {}^{\circ}\text{C}$	P _{tot}	max.	100	mW
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; ($I_B = 0$)	I _C /I _F	>	0,2	
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 10 kV		_	200	•
diode: I _F = 0 (see also Fig. 4)	ICEW	<	200	
Isolation voltage (d.c.)	v_{IORM}	min.	10	kV

MECHANICAL DATA

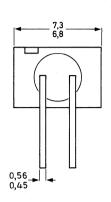
SOT-211 (see Fig. 1)

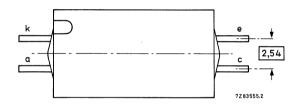
→ MECHANICAL DATA

Fig. 1 SOT-211.



Dimensions in mm





→ RATINGS

d.c.

peak value

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode				
Continuous reverse voltage	ΫR	max.	5	V
Forward current				
d.c.	Ιϝ	max.	- 50	mΑ
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$	l _{FRM}	max.	3	Α
Total power dissipation up to $T_{amb} = 25 {}^{\circ}C$	P _{tot}	max.	100	mW
Transistor	v			
Collector-emitter voltage (open base)	V _{CEO}	max.	30	V
Emitter-collector voltage (open base)	VECO	max.	7	V
Collector current				

lc

ICM

P_{tot}

25 mA

50 mA

100 mW

max.

max.

max.

April 1986

Total power dissipation up to $T_{amb} = 25$ °C

		_		
Optocoupler				
Storage temperature	T _{stq}	-55 to	+ 100	оС
Junction temperature	T _i	max.	100	оС
Lead soldering temperature up to the seating plane; $t_{\mbox{sld}} < 10 \mbox{ s}$	T _{sld}	max.	260	оС
THERMAL RESISTANCE				
From junction to ambient in free air diode transistor	R _{th} j-a R _{th j-a}	max. max.	750 750	•
From junction to ambient, device mounted on a printed circuit board diode transistor	R _{th j-a} R _{th j-a}	max. max.	400 400	
CHARACTERISTICS				
T _j = 25 ^o C unless otherwise specified				
Diode				
Forward voltage I _F = 10 mA	V _F	typ.	1,15 1,3	
Reverse current V _R = 5 V	I _R	<	100	
Diode capacitance at $f = 1 \text{ MHz}$ V _R = 0	c_d	typ.	40	pF
Transistor				
Collector cut-off current (dark) VCE = 10 V	I _{CEO}	typ.	2 50	nA nA
Collector-emitter breakdown voltage open base; $I_C = 1 \text{ mA}$	V _(BR) CEO	min.	30	V
Emitter-collector breakdown voltage open base; IE = 0,1 mA	V(BR)ECO	min.	7	v
Optocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; V _{CE} = 0,4 V	I _C /I _F	min. typ.	0,2 0,5	
Collector-emitter saturation voltage I _F = 10 mA; I _C = 2 mA	V _{CEsat}	typ.	0,15	V

Note see next page.

Isolation voltage, d.c. value (see note 1)

min.

VIORM

10 kV

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Capacitance between input and output $I_F=0; V=0; f=1 \text{ MHz}$ C_{io} typ. 0,15 pF Insulation resistance between input and output $\pm V_{IO}=1 \text{ kV}$ r_{IO} t_{IO} $t_$

Common mode rejection (see Fig. 3) $I_C = 2 \text{ mA}$, f = 10 kHz CMRR typ. 85 dB Switching times (see Fig. 13)

 $I_{\text{Con}} = 2 \text{ mA}; V_{\text{CC}} = 5 \text{ V}; R_{\text{L}} = 100 \Omega$

Turn-on time
Turn-off time

 I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω Turn-on time

Collector cut-off current (dark) see Fig. 2 V_{CC} = 10 V; working voltage (d.c.) = 10 kV

ton

toff

ton

toff

typ.

typ.

typ.

typ.

3 μs

3 μs

12 μs

12,5 µs

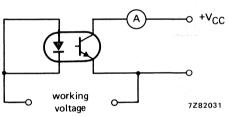


Fig. 2.

Notes

- 1. This parameter is tested with both input (diode) leads shorted together and both output (photo-transistor) leads shorted together at 10 kV (d.c.) for 1 min. Tested on sample basis.
- 2. CMRR = $\frac{V_o}{V_{CM}}$

Turn-off time

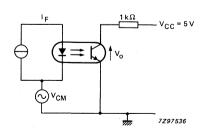


Fig. 3.

78

^{*} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

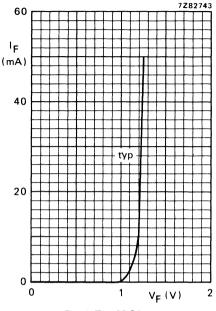


Fig. 4 $T_{i} = 25 \, {}^{\circ}\text{C}$.

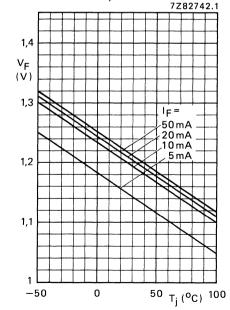
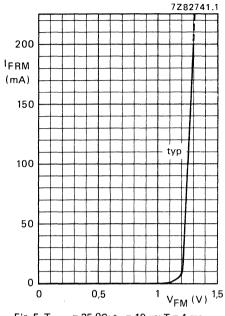


Fig. 6 Typical values.



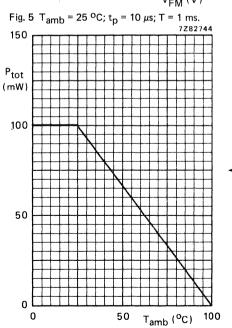


Fig. 7 Power derating curve for diode and transistor versus ambient temperature.

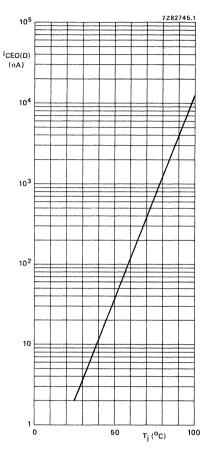


Fig. 8 Typical values.

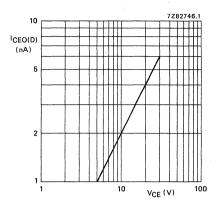


Fig. 9 Typical values.

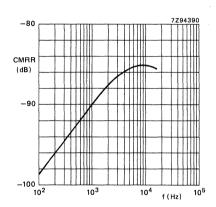


Fig. 10 Typical values.

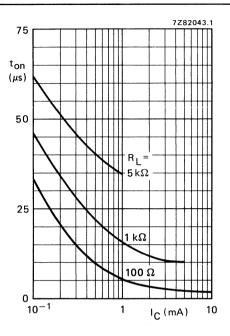


Fig. 11 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. See also Fig. 13.

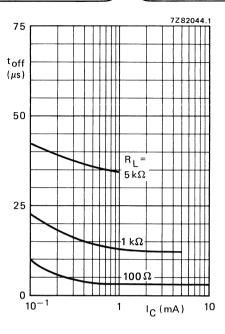
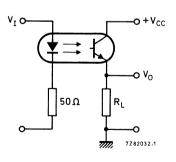


Fig. 12 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values. See also Fig. 13.



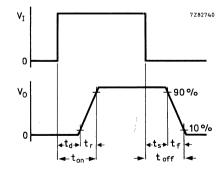


Fig. 13 Switching circuit and waveforms.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n photo transistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.).

QUICK REFERENCE DATA

Diode						
Continuous reverse voltage		٧R	max.	5	V	4
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0.01$		l _F lFRM	max. max.		mA A	
Total power dissipation up to $T_{amb} = 25$ °C		P _{tot}	max.	200	mW	
Transistor						
Collector-emitter voltage (open base)		VCEO	max.	30	V	
Total power dissipation up to T _{amb} = 25 °C		P_{tot}	max.	200	mW	
Optocoupler						
Output/input d.c. current transfer ratio (C.T.R.) I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	CNX35 CNX39 CNX36	I _C /I _F	0,6	to 0,9 to 1,0 to 2,0		4
Collector cut-off current (dark) VCC = 10 V; working voltage (d.c.) = 2,5 kV diode: IF = 0 (see also Fig. 2)		ICEW	max.	200	nA	
Isolation voltage (d.c.)		v_{IORM}	min.	4,4	kV	

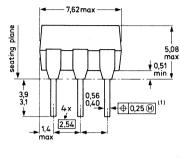
MECHANICAL DATA

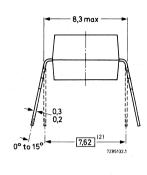
SOT-90B (see Fig. 1).

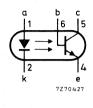
CNX35 CNX36 CNX39

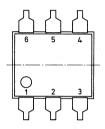
MECHANICAL DATA Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- (M) Maximum Material Condition.
 - of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.

Centre-lines of all leads are within ± 0.125 mm

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

(1)

Forward current

Continuous reverse voltage

 V_{R}

max.

100 mA

max. max.

max.

max.

max.

3 A

5 V

(peak value); $t_p = 10 \,\mu s$; $\delta = 0.01$

IFRM P_{tot}

Transistor

Collector-emitter voltage (open base)

Total power dissipation up to $T_{amb} = 25$ °C

Total power dissipation up to Tamb = 25 °C

۱F

200 mW max.

Collector-base voltage (open emitter)

V_{CBO}

30 V 70 V

200 mW

Emitter-collector voltage (open base)

Collector current (d.c.)

VECO lC

P_{tot}

VCEO

7 V max. 100 mA max.

January 1981

from the symbols.

Optocoupler						
Storage temperature		T_{stg}	-55 to	+150	oC	-
Operating junction temperature		T _j	max.	125	oC	
Lead soldering temperature up to the seating plane; $t_{sld} < 10 s$		T _{sld}	max.	260	oC	
THERMAL RESISTANCE						
From junction to ambient in free air						
diode transistor		R _{th j-a}	=		K/W K/W	
From junction to ambient, device		R _{th j-a}	_	500	IX/ VV	
mounted on a printed-circuit board						
diode		R _{th j-a}	=		K/W	
transistor		R _{th j-a}	=	400	K/W	
ISOLATION RELATED VALUES						
External air gap (clearance)						
input terminals to output terminals		L(IO1)	min.	7,2	mm	
External tracking path (creepage dist)		L(102)	min.	7.0	mm	
input terminals to output terminals Tracking resistance (KB-value)		L(102)		7,0 00/A	111111	
Tracking resistance (ND-value)			KD-1	00, A		
CHARACTERISTICS						
T _j = 25 °C unless otherwise specified						
Diode						
Forward voltage			typ.	1,15	V	
IF = 10 mA		VF	max.	1,5		
Reverse current						
$V_R = 5 V$		۱R	max.	10	μΑ	•
Transistor (IF = 0)						
Collector cut-off current (dark)				_	^	
V _{CE} = 10 V		ICEO	typ. max.	_	nA nA	
V _{CE} = 10 V; T _{amb} = 70 °C		ICEO	max.		μΑ	
V _{CB} = 10 V		СВО	max.	20	nΑ	
Collector-emitter breakdown voltage		.,	ē			
at $I_C = 1 \text{ mA}$		V(BR)CEO	min.	30	V	
Collector-base breakdown voltage at I _C = 0,1 mA		V(BR)CBO	min.	70	V	
Emitter-collector breakdown voltage		4 (RH)CRO		, 0	٧,	
at I _E = 0,1 mA		V(BR)ECO	min.	7	V	
Optocoupler (I _B = 0)*						
Output/input d.c. current transfer ratio (C.T.R.)						
$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	CNX35	IC/IF	,	0,9		4-
	CNX39 CNX36	C/ F C/ F		o 1,0 o 2,0		
	CIAVOR	'U/TE	0,0 (U,2,U		

* Where the phototransistor receives light from the diode the O (for open base) has been omitted

Output/input d.c. current transfer ratio (C.T.R.)

	Output/input d.c. current transfer ratio (C.1.11.)					
	$I_F = 10 \text{ mA; } V_{CE} = 5 \text{ V}$		I _C /I _F	typ.	1,5	
▶ .	Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 2 \text{ mA}$	CNX35 CNX39	VCEsat	max. typ.	0,4 0,15	
	$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$	CNX36	v_{CEsat}	max. typ.	0,4 0,19	
	Isolation voltage **		VIORM	min.	•	kV (d.c.)
	Collector cut-off current (light) at $T_{amb} = 0$ °C to 7 $V_F = 0.8$ V; $V_{CE} = 15$ V $I_F = 2$ mA; $V_{CE} = 0.4$ V	0 oC	ICE(L)	max. min.	•	kV (r.m.s.) μΑ μΑ
	Collector capacitance at $f = 1 \text{ MHz}$ $I_E = I_e = 0$; $V_{CB} = 10 \text{ V}$		C _{bc}	typ.	4,5	pF
	Capacitance between input and output I _F = 0; V = 0; f = 1 MHz		Cio	typ.	0,6	pF
	Insulation resistance between input and output $\pm V_{10} = 1 \text{ kV}$		rlo	min. typ.	10 ^{1 0} 10 ^{1 2}	
	Switching times (see Figs 2 and 3) $I_{Con} = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_1 = 100 \Omega$		CNX35	CNX39	CNX36	
	Turn-on time	ton	typ. 3	5,5	8	μs
	Turn-off time	toff	typ. 3	4	6	μs
	$I_{\mbox{Con}}$ = 2 mA; $V_{\mbox{CC}}$ = 5 V; $R_{\mbox{L}}$ = 1 k Ω Turn-on time Turn-off time	^t on ^t off	typ. 12 typ. 12	14 12	20 18	•
	Collector cut-off current (dark) see Fig. 4 VCC = 10 V; working voltage (d.c.) = 2,5 kV	70.00	CEW	max.		nΑ* μΑ*
	$V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 2,5 kV; $T_j =$	70 -0	CEW	max.	100	μΛ

As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

Tested on a sample basis with a voltage of 4400 Vdc for 1 minute between the shorted input (diode) leads and the shorted output (phototransistor) leads.

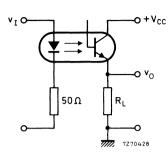


Fig. 2 Switching circuit.

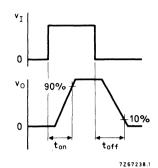


Fig. 3 Waveforms.

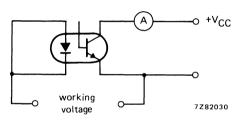


Fig. 4.

CNX35 CNX36 CNX39

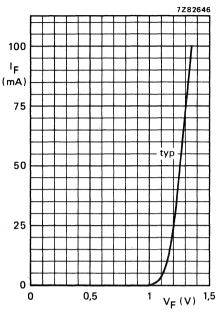


Fig. 5 T_{amb} = 25 °C.

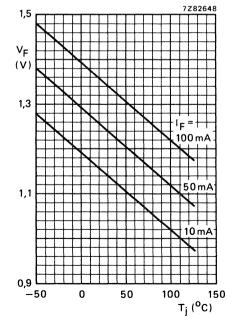


Fig. 7 Typical values.

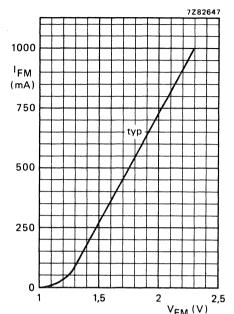


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms.

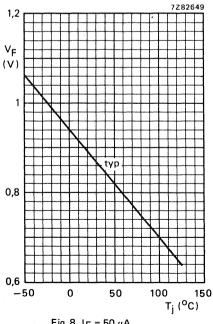


Fig. 8 I_F = $50 \mu A$.

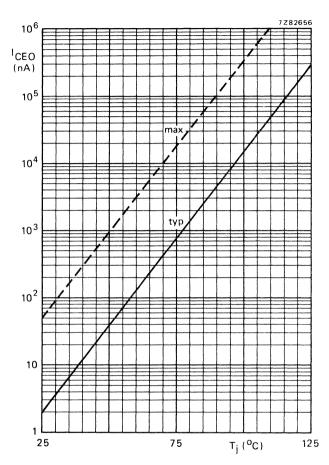


Fig. 9 IF = 0; VCE = 10 V.

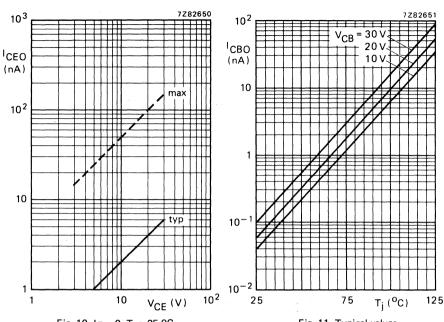


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

Fig. 11 Typical values.

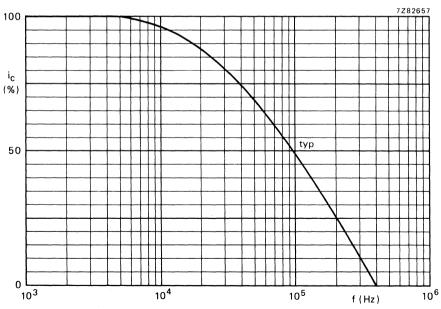


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ k Ω ; $T_{amb} = 25$ °C.

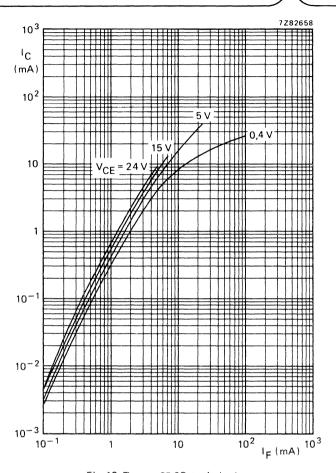


Fig. 13 $T_{amb} = 25$ °C, typical values.

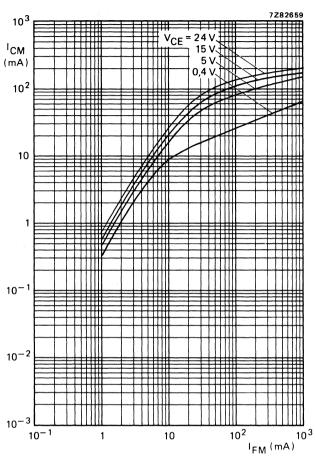


Fig. 14 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

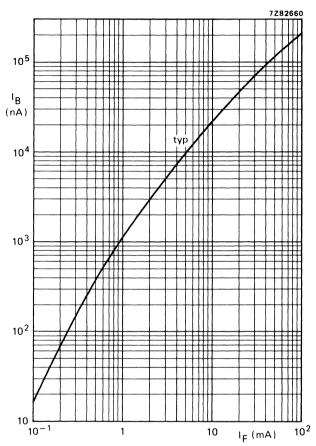


Fig. 15 $V_{CB} = 5 V$; $T_{amb} = 25 °C$.

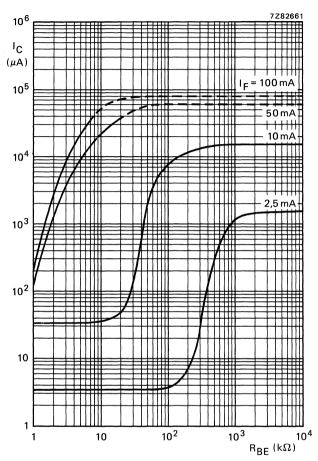


Fig. 16 $I_B = 0$; $V_{CE} = 5 V$; $T_{amb} = 25 \, ^{o}C$; typical values.

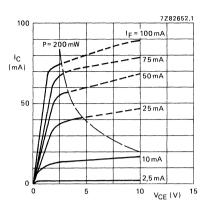


Fig. 17 Tamb = 25 °C; typical values.

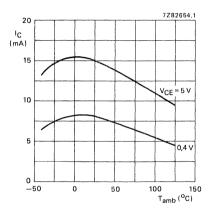


Fig. 19 IF = 10 mA; typical values.

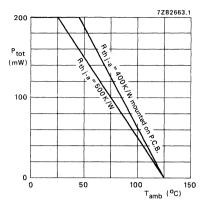


Fig. 18.

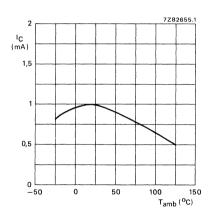


Fig. 20 $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

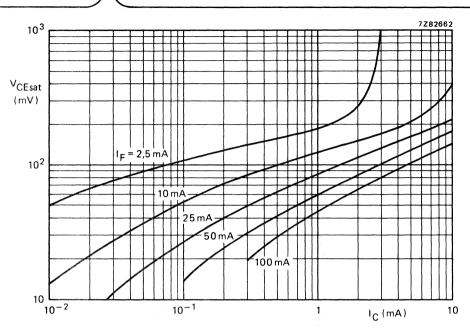


Fig. 21 I_B = 0; T_{amb} = 25 °C; typical values.

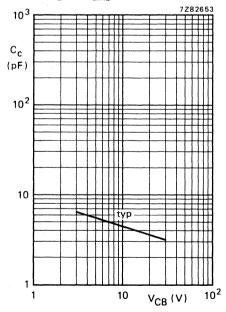


Fig. 22 f = 1 MHz; T_{amb} = 25 °C.

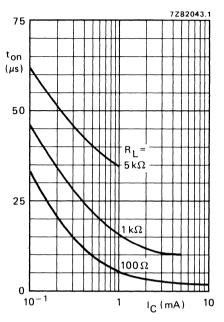


Fig. 23 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values. (See also Fig. 25) CNX35.

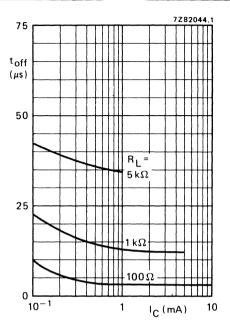
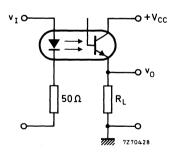


Fig. 24 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values. (See also Fig. 25) CNX35.



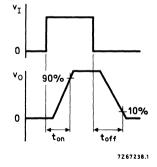


Fig. 25 Switching circuit and waveforms.



OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n photo transistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.)

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

Diode						
Continuous reverse voltage		v_R	max.	5	V	•
Forward current d.c.		l _F	max.	100 3	mA A	
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$ Total power dissipation up to $T_{amb} = 25 {}^{\circ}\text{C}$		IFRM P _{tot}	max. max.	200		
Total power dissipation up to Tamb - 25 °C		' tot	max.	200	11100	
Transistor						
Collector-emitter voltage (open base)		VCEO	max.	30	V	
Total power dissipation up to T _{amb} = 25 °C		P_{tot}	max.	200	mW	
Optocoupler						4
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; ($I_B = 0$)	CNX35U CNX39U CNX36U	^I C/IF	0,6	to 0,9 to 1,0 to 2,0		
Collector cut-off current (dark) VCC = 10 V; working voltage (d.c.) = 2,5 kV diode: IF = 0 (see also Fig. 2) Isolation voltage (d.c.)		CEW	max. min.	200 4,4		
isolation voltage (u.c.)		VIORM	111111.	4,4	K V	

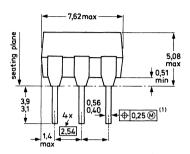
MECHANICAL DATA

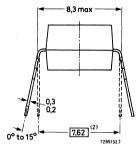
SOT-90B (see Fig. 1).

MECHANICAL DATA

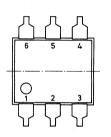
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- M Maximum Material Condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode			
Continuous reverse voltage	v _R	max.	5 V
Forward current d.c. (peak value); t _p = 10 μs; δ = 0,01	l _F lerm	max. max.	100 mA 3 A
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V _{CEO}	max.	30 V
Collector-base voltage (open emitter)	V _{CBO}	max.	70 V
Emitter-collector voltage (open base)	V _{ECO}	max.	7 V

Collector current (d.c.)

Total power dissipation up to $T_{amb} = 25$ °C

Optocouplers

CNX35U CNX36U CNX39U

)		CNX	390
Optocoupler				
Storage temperature	T_{stg}	−55 t	o +150 °C	-
Operating junction temperature	T _i	max.	125 °C	3
Lead soldering temperature	,			
up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C	
THERMAL RESISTANCE				
From junction to ambient in free air				
diode	R _{th j-a}	=	500 K	/W
transistor	R _{th j-a}	=	500 K	/W
From junction to ambient, device	•			
mounted on a printed-circuit board				
diode	R _{th j-a}	=	400 K	
transistor	R _{th j-a}	=	400 K	/W
ISOLATION RELATED VALUES				
External air gap (clearance)				
input terminals to output terminals	L(IO1)	min.	7,2 m	m
External tracking path (creepage dist)				
input terminals to output terminals	L(102)	min.	7,0 m	m
Tracking resistance (KB-value)		KB-	-100/A	
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage				
I _F = 10 mA	VF	typ.	1,15 V	
	,	max.	1,5 V	
Reverse current	1 -		40	
V _R = 5 V	IR	max.	10 μΑ	+
Transistor $(I_F = 0)$				
Collector cut-off current (dark)			•	
V _{CE} = 10 V	ICEO	typ.	2 n <i>A</i> 50 n <i>A</i>	
V _{CE} = 10 V; T _{amb} = 70 °C	ICEO	max. max.	50 n.ε 10 μ.ε	
VCB = 10 V	ICBO	max.	20 n A	
Collector-emitter breakdown voltage	.000	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		•
at I _C = 1 mA	V(BR)CEO	min.	30 V	
Collector-base breakdown voltage	· (BN/CLO			
at I _C = 0,1 mA	V(BR)CBO	min.	70 V	
Emitter-collector breakdown voltage	(DIT/CDO			
at I _E = 0,1 mA	V(BR)ECO	min.	7 V	
Optocoupler (I _B = 0)*	(=::,=00			
Output/input d.c. current transfer ratio (C.T.R.)				
1 40 4 14	ONIVOELL L-/L-	0.4		_

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

CNX35U

CNX39U

CNX36U

IC/IF

IC/IF

IC/IF

 $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

0,4 to 0,9

0,6 to 1,0 0,8 to 2,0

CNX35U CNX36U CNX39U

Output/input d.c. current transfer ratio (C.T.R.) I _F = 10 mA; V _{CE} = 5 V		I _C /I _F	typ.	1,5	
Collector-emitter saturation voltage	CNX35U CNX39U	V _{CEsat}	max. typ.	0,4 0,15	
I _F = 10 mA; I _C = 4 mA	CNX36U	V _{CEsat}	max. typ.	0,4 0,19	
Isolation voltage, d.c. value**		V_{IORM}	min.	4,4	kV
Isolation voltage, r.m.s. value		v_{IORM}	min.	3,12	kV
Collector cut-off current (light) at Tamb = 0 °C to	70 °C				
$V_F = 0.8 V$; $V_{CE} = 15 V$ $I_F = 2 mA$; $V_{CE} = 0.4 V$		ICE(L)	max. min.	15 150	μΑ μΑ
Collector capacitance at f = 1 MHz I _E = I _e = 0; V _{CB} = 10 V		C _{bc}	typ.	4,5	pF
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz		Cio	typ.	0,6	pF
Insulation resistance between input and output $\pm V_{10} = 1 \text{ kV}$		rio	min. typ.	10 ^{1 0} 10 ^{1 2}	Ω
Switching times (see Figs 2 and 3) $I_{Con} = 2 \text{ mA: VCC} = 5 \text{ V: R}_{1} = 100 \Omega$		CNX35U	CNX39U	CNX36	6U
Turn-on time	ton	typ. 3	5,5	8	μs
Turn-off time	^t off	typ. 3	4	6	μs
$I_{Con} = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$					
Turn-on time	^t on	typ. 12	14		μs
	^t off	typ. 12	12	18	μs
Collector cut-off current (dark) see Fig. 4 $V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 2,5 kV $V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 2,5 kV; Tj	= 70 °C	CEW	max. max.		nΑ* μΑ*
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz Insulation resistance between input and output $\pm V_{IO} = 1$ kV Switching times (see Figs 2 and 3) $I_{Con} = 2$ mA; $V_{CC} = 5$ V; $R_L = 100$ Ω Turn-on time Turn-off time $I_{Con} = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ k Ω Turn-on time Turn-off time $I_{Con} = 2$ mA; $I_{Con} = 2$	^t off ton toff	Cio rIO CNX35U typ. 3 typ. 12 typ. 12	typ. min. typ. CNX39U 5,5 4 14 12 max.	0,6 10 ¹⁰ 10 ¹² CNX36 8 6 20 18	pF Ω Ω μs μs μs μs

^{*} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

^{**} Every single product is tested by applying an isolation test voltage of 3750 Vac (rms) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

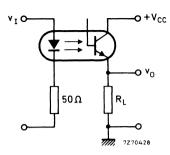


Fig. 2 Switching circuit.

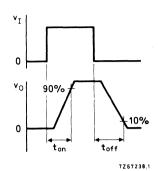


Fig. 3 Waveforms.

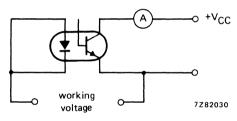


Fig. 4.

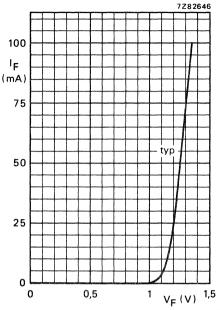


Fig. 5 T_{amb} = 25 °C.

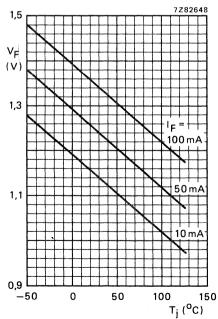


Fig. 7 Typical values.

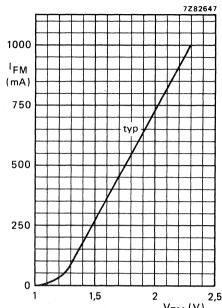


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms.

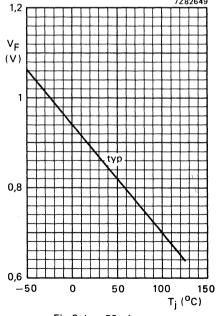


Fig. 8 I_F = $50 \mu A$.

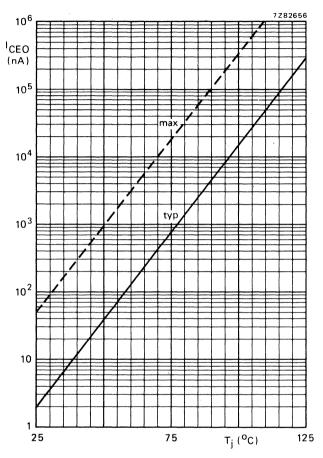


Fig. 9 I_F = 0; V_{CE} = 10 V.

CNX35U CNX36U CNX39U

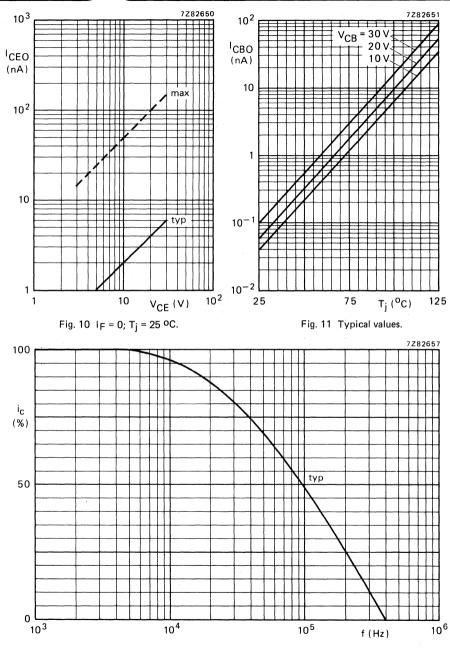


Fig. 12 I $_B$ = 0; I $_C$ = 2 mA; V $_{CC}$ = 5 V; R $_L$ = 1 k Ω ; T $_{amb}$ = 25 °C.

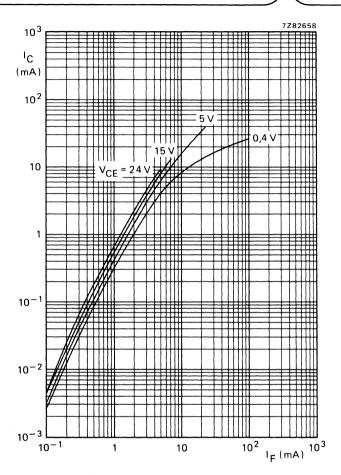


Fig. 13 $T_{amb} = 25$ °C, typical values.

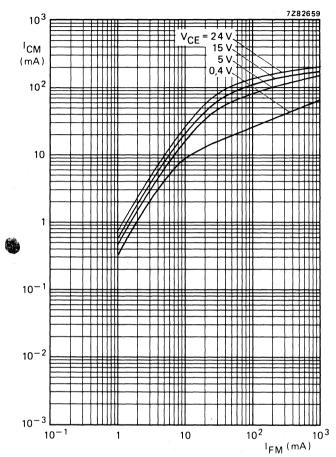


Fig. 14 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

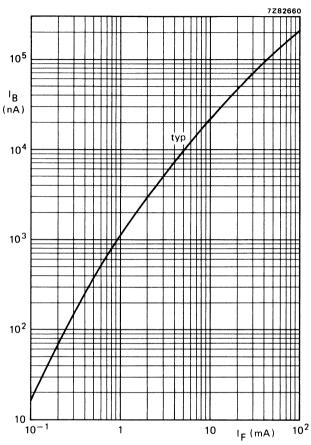


Fig. 15 $V_{CB} = 5 V$; $T_{amb} = 25 °C$.

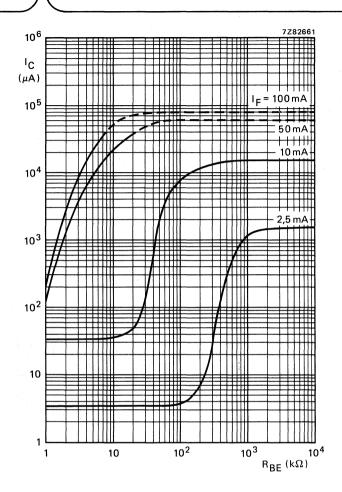


Fig. 16 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \, ^{o}\text{C}$; typical values.

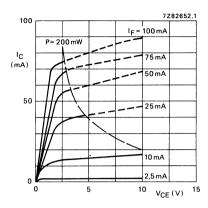


Fig. 17 T_{amb} = 25 °C; typical values.

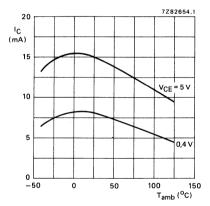


Fig. 19 IF = 10 mA; typical values.

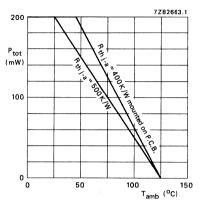


Fig. 18.

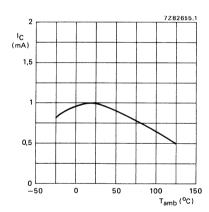


Fig. 20 $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

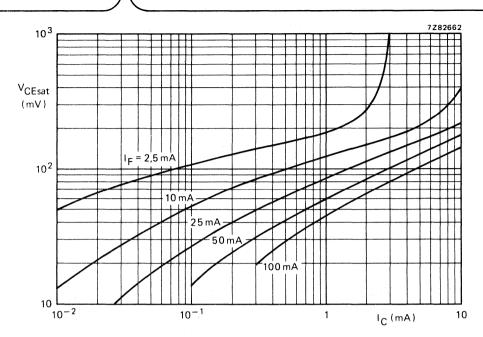


Fig. 21 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

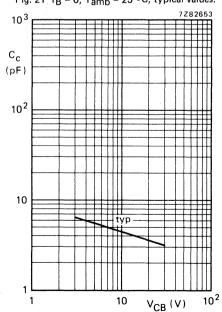


Fig. 22 f = 1 MHz; $T_{amb} = 25 \text{ oC}$.

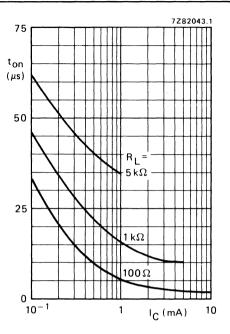


Fig. 23 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values. (See also Fig. 25).

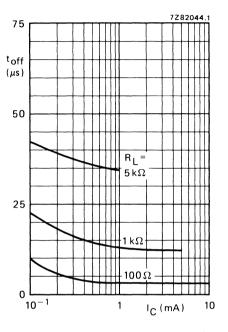
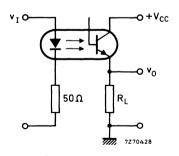


Fig. 24 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 25).



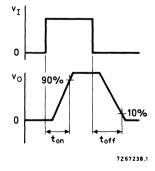


Fig. 25 Switching circuit and waveforms.



OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor with accessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.)

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	l _F	max. max.	100 mA 3 A
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 10 V; (IB = 0)	IC/IF	0,7 t	:o 2,1
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV diode; I _F = 0 (see also Fig. 4)	^I CEW	max.	200 nA
Isolation voltage (d.c.)	VIORM	min.	4,4 kV

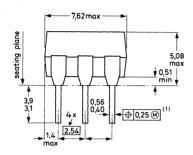
MECHANICAL DATA

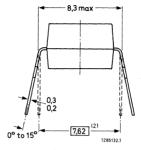
SOT-90B (see Fig. 1).

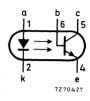
MECHANICAL DATA

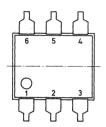
Dimensions in mm

Fig. 1 SOT-90B.









- Positional accuracy.
- (M) Maximum Material Condition.
- (1) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.

 V_{R}

max.

5 V

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Forward current				
d.c.	l _E	max.	100	mΑ
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3	Α
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	200	mW
Transistor				
Collector-base voltage (open emitter)	v_{CBO}	max.	120	٧
Collector-emitter voltage (open base)	V _{CEO}	max.	80	٧
Emitter-collector voltage (open base)	V _{ECO}	max.	7	٧
Collector current (d.c.)	Ιc	max.	100	mΑ
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200	mW

Continuous reverse voltage

Optocoupler				
Storage temperature	T_{stg}	-55 te	o +150 °C	-
Operating junction temperature	Τį	max.	125 °C	
Lead soldering temperature	•			
up to the seating plane; $t_{ m sld}$ $<$ 10 s	T _{sld}	max.	260 °C	
THERMAL RESISTANCE				
From junction to ambient in free air				
diode	R _{th j-a}	=	500 K/W	
transistor	R _{th j-a}	=	500 K/W	
From junction to ambient, device				
mounted on a printed-circuit board diode	D., .	=	400 K/W	
transistor	R _{th j-a} R _{th j-a}	=	400 K/W	
	··ui j-a		100 11,11	
ISOLATION RELATED VALUES				
External air gap (clearance)			- 0	
input terminals to output terminals	L(IO1)	min.	7,2 mm	
External tracking path (creepage dist)	1 (103)	!	7.0	
input terminals to output terminals	L(102)	min.	7,0 mm	
Tracking resistance (KB-value)		KB	-100/A	
CHARACTERISTICS				
T _i = 25 °C unless otherwise specified				
,				
Diode				
Forward voltage		typ.	1,15 V	
IF = 10 mA	٧F	<	1,5 V	
Reverse current				
V _R = 5 V	^I R	<	10 μΑ	-
Transistor (IF = 0)				
Collector cut-off current (dark)				
VCE = 50 V	ICEO	typ.	2 nA	
		<	50 nA	
V _{CE} = 50 V; T _{amb} = 70 °C V _{CB} = 10 V; T _{amb} = 25 °C	ICEO	< <	10 μA 20 nA	
	ICBO		20 11A	
Collector-emitter breakdown voltage at I _C = 1 mA	V(BR)CEO	min.	80 V	
Collector-base breakdown voltage	· (BN/CEO			
at IC = 0,1 mA	V _(BR) CBO	min.	120 V	
Emitter-collector breakdown voltage	(511)050		•	
at I _E = 0,1 mA	V _{(BR)ECO}	min.	7 V	
	,,0			

Optocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$ $I_F = 16 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	C/ F C/ F	> 0,7	to 2,1 0,5	
Collector-emitter saturation voltage $I_F = 16 \text{ mA}$; $I_C = 2 \text{ mA}$	V _{CEsat}	typ.	0,2 V 0,4 V	
Isolation voltage **	VIORM	min.	4,4 kV(c	,
Collector capacitance at $f = 1 \text{ MHz}$ $I_E = I_e = 0$; $V_{CB} = 10 \text{ V}$	Cc	typ.	3,12 kV 4,5 pF	(r.m.s.)
Capacitance between input and output IF = 0; V = 0; f = 1 MHz	Cio	typ.	0,6 pF	
Insulation resistance between input and output $\pm V_{1O} = 1 \text{ kV}$	rIO	> typ.	$10^{10} \Omega$ $10^{12} \Omega$	
Switching times (see Figs 2 and 3) I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω T_{urn} -on time T_{urn} -off time	^t on ^t off	typ.	5 μs 5 μs	
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 1 $k\Omega$ Turn-on time Turn-off time	t _{on}	typ.	15 μs 15 μs	
Collector cut-off current $V_F = 0.8 \text{ V}; -V_{CE} = 15 \text{ V}$ $T_{amb} = 0 \text{ °C to +70 °C}$	I _{CE1}	max.	15 μΑ	
Collector cut-off current at $I_F = 2 \text{ mA}$; $-V_{CE} = 0.4 \text{ V}$ $T_{amb} = 0 \text{ °C to +}70 \text{ °C}$	I _{CE2}	min.	150 μΑ	

ICEW

ICEW

200 nA▲

100 μA▲

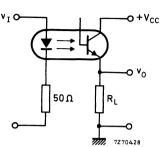
Collector cut-off current (dark) see Fig. 4 V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV

 $V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5 kV; $T_i = 70 \text{ °C}$

Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Tested on a sample basis with a voltage of 4400 Vdc for 1 minute between the shorted input (diode) leads and the shorted output (phototransistor) leads.

As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.





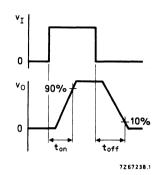


Fig. 3 Waveforms.

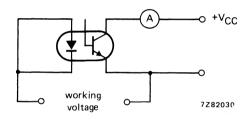


Fig. 4.

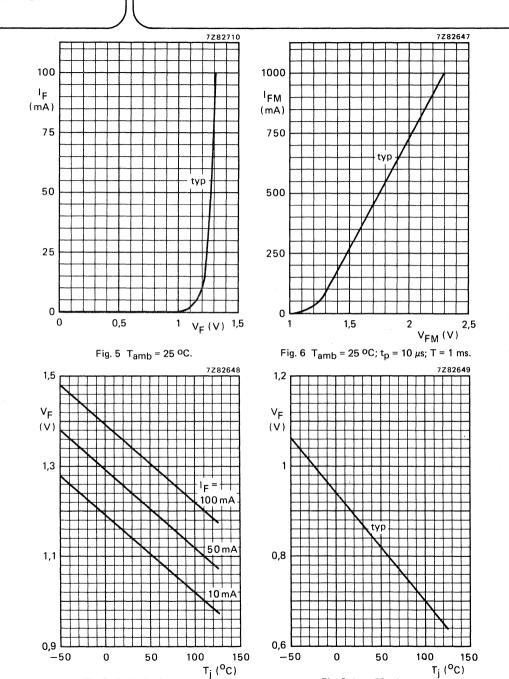


Fig. 8 $I_F = 50 \,\mu\text{A}$.

Fig. 7 Typical values.

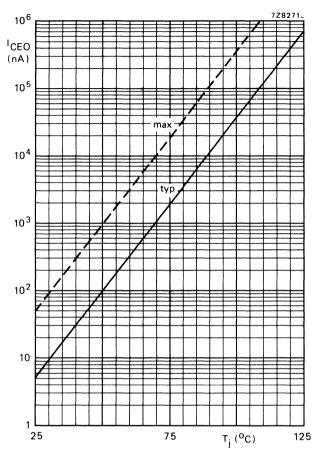
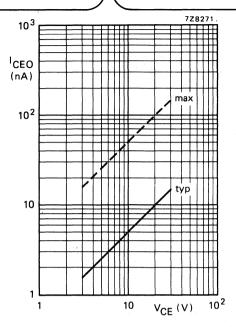


Fig. 9 $I_F = 0$; $V_{CE} = 10 \text{ V}$.



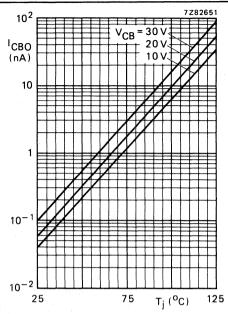


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

Fig. 11 Typical values.

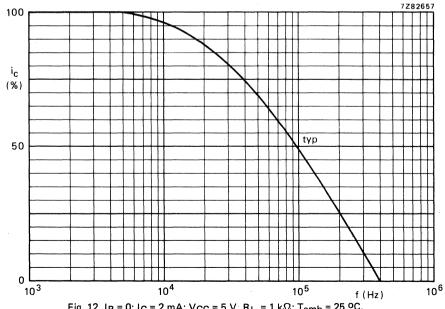


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1$ k Ω ; $T_{amb} = 25$ °C.

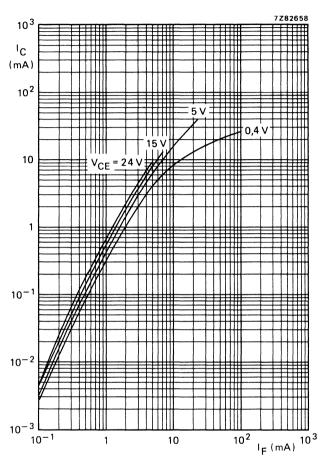


Fig. 13 $T_{amb} = 25$ °C, typical values.

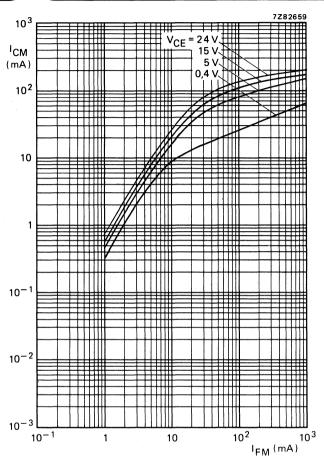


Fig. 14 T_{amb} = 25 °C; t_p = 20 μ s; T = 2 ms; typical values.

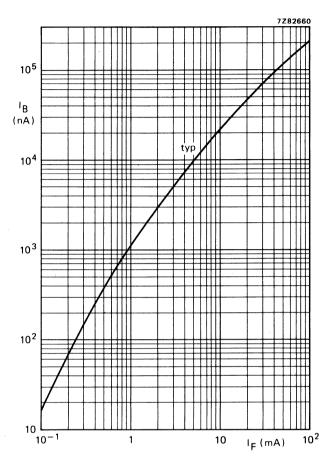


Fig. 15 $V_{CB} = 5 V$; $T_{amb} = 25 °C$.

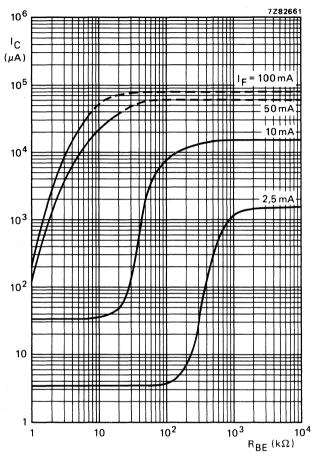


Fig. 16 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

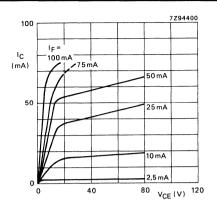


Fig. 17 $T_{amb} = 25$ °C; typical values.

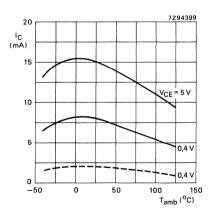


Fig. 19 IF = 10 mA; typical values.

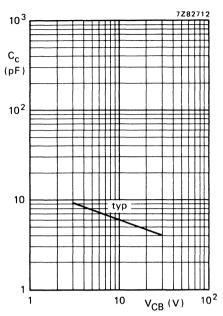


Fig. 18 f = 1 MHz; $T_{amb} = 25 \text{ oC}$.

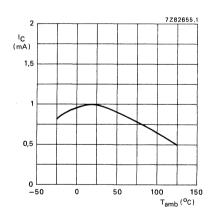


Fig. 20 IF = 2 mA; typical values.

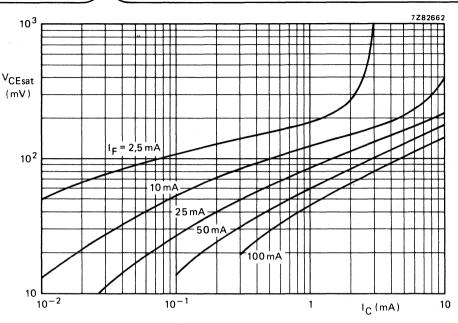


Fig. 21 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

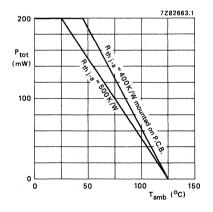


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

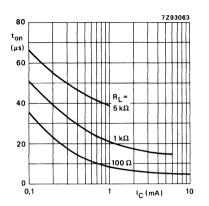


Fig. 23 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 25.)

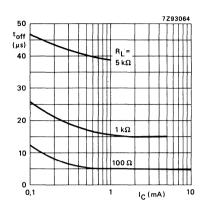
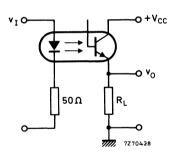


Fig. 24 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C, typical values. (See also Fig. 25.)



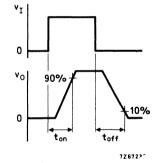


Fig. 25 Switching circuit and waveforms.



OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a high voltage silicon n-p-n phototransistor with assessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features of this product:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.)
- working voltage 2,5 kV (d.c.)

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with: DIN 57 804/VDE 0804/1.83 (isolation group C)

DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

Diode					
Continuous reverse voltage	v_R	max.	5	٧	
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$ Total power dissipation up to $T_{amb} = 25 \ ^{O}C$	I _F I _{FRM} P _{tot}	max. max. max.		mA A mW	
Transistor					
Collector-emitter voltage (open base)	v_{CEO}	max.	80	V	
Total power dissipation up to $T_{amb} = 25 {}^{\circ}C$	P_{tot}	max.	200	mW	
Optocoupler					
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; ($I_B = 0$)	I _C /I _F	0,7 t	o 2,1		
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV diode; I _F = 0 (see also Fig. 4)	¹ CEW	max.	200	nA	
Isolation voltage (d.c.)	V _{IORM}	min.	4,4	kV	

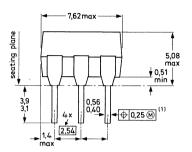
MECHANICAL DATA

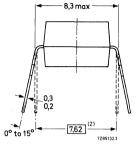
SOT-90B (see Fig. 1).

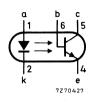
MECHANICAL DATA

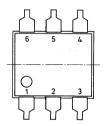
Dimensions in mm

Fig. 1 SOT-90B.









- Positional accuracy.
- M Maximum Material Condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

─► Continuous reverse voltage	v_R	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	l _F lFRM	max. max.	100 mA 3 A
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	200 mW
Transistor			
Collector-base voltage (open emitter)	v_{CBO}	max.	120 V
Collector-emitter voltage (open base)	v_{CEO}	max.	80 V
Emitter-collector voltage (open base)	VECO	max.	7 V
Collector current (d.c.)	1 _C	max.	100 mA
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW

Optocoupler					
Storage temperature	T _{stq}	-55 to	+150	οС	-
Operating junction temperature	T _i	max.	125	οС	
Lead soldering temperature	,				
up to the seating plane; $t_{\rm sld}$ < 10 s	T _{sld}	max.	260	oC	
THERMAL RESISTANCE					
From junction to ambient in free air					
diode	R _{th j-a}	=	500	K/W	
transistor	R _{th j-a}	=	500	K/W	
From junction to ambient, device					
mounted on a printed-circuit board diode	R _{th j-a}	=	400	K/W	
transistor	R _{th j-a}	=		K/W	
ISOLATION RELATED VALUES	, .				
External air gap (clearance)					
input terminals to output terminals	L(IO1)	min.	7,2	mm	
External tracking path (creepage dist)			·		
input terminals to output terminals	L(102)	min.	7,0	mm	
Tracking resistance (KB-value)		KB-1	00/A		
CHARACTERISTICS					
T _j = 25 °C unless otherwise specified					
Diode					
Forward voltage IF = 10 mA	VF	typ.	1,15	V	
1F = 10 IIIV	V F	< '	1,5	V	
Reverse current			40		
V _R = 5 V	IR	<	10	μΑ	-
Transistor (I _F = 0)					
Collector cut-off current (dark)		.	2	nA	
V _{CE} = 50 V	ICEO	typ.		nA	
V _{CE} = 50V; T _{amb} = 70 °C	ICEO	<	10	μΑ	
V _{CB} = 10 V; T _{amb} = 25 °C	ГСВО	<	20	nΑ	
Collector-emitter breakdown voltage	V/	!	90	\ /	
at IC = 1 mA	V(BR)CEO	min.	80	V	
Collector-base breakdown voltage at I _C = 0,1 mA	V(BR)CBO	min.	120	V	
Emitter-collector breakdown voltage	(511/050				
at I _E = 0,1 mA	V(BR)ECO	min.	7	V	

→ Optocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$ $I_F = 16 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	I _C /I _F I _C /I _F	> 0,7	to 2,1 0,5	
Collector-emitter saturation voltage $I_F = 16 \text{ mA}$; $I_C = 2 \text{ mA}$	V _{CEsat}	typ.	0,2 0,4	
—► Isolation voltage**	VIORM	min.		kV(d.c.) kV(r.m.s.)
Collector capacitance at $f = 1 \text{ MHz}$ $I_E = I_e = 0$; $V_{CB} = 10 \text{ V}$	C _c	typ.	4,5	pF
Capacitance between input and output I _F = 0; V = 0; f = 1 MHz	C _{io}	typ.	0,6	pF
Insulation resistance between input and output ± V _{IO} = 1 kV	r _{IO}	> typ.	10 ¹¹ 10 ¹²	
Switching times (see Figs 2 and 3) I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω T_{urn} -on time T_{urn} -off time	t _{on} t _{off}	typ. typ.	5 5	="
I _{Con} = 4 mA; V _{CC} = 5 V; R _L = 1 kΩ Turn-on time Turn-off time	^t on ^t off	typ. typ.	15 15	-
Collector cut-off current $V_F = 0.8 \text{ V}; -V_{CE} = 15 \text{ V}$ $T_{amb} = 0 \text{ °C to} + 70 \text{ °C}$	I _{CE1}	max.	15	μΑ
Collector cut-off current at $I_F = 2 \text{ mA}$; $-V_{CE} = 0.4 \text{ V}$ $T_{amb} = 0 ^{0}\text{C}$ to $+ 70 ^{0}\text{C}$	I _{CE2}	min.	150	μΑ
Collector cut-off current (dark) see Fig. 4 $V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5 kV $V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5 kV; $T_j = 70 ^{\circ}\text{C}$	ICEW ICEW	< <		nA ▲ μA ▲

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

^{**} Every single product is tested by applying an isolation test voltage of 3750 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

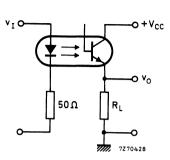


Fig. 2 Switching circuit.

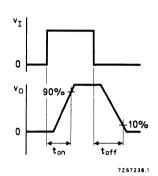


Fig. 3 Waveforms.

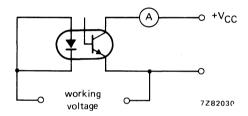
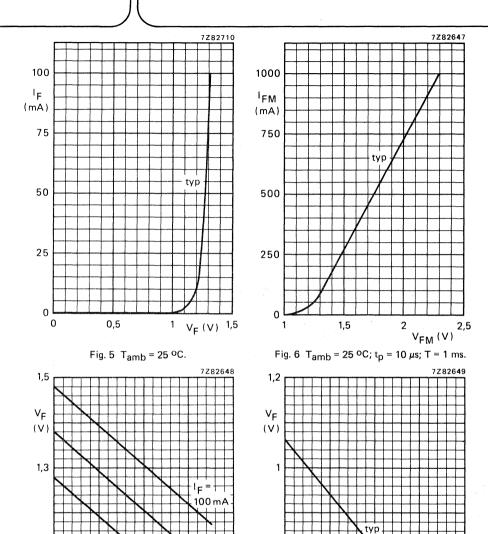


Fig. 4.



50 mA

10 mA

T_i (°C)

150

100

0,8

0,6

_50

Fig. 7 Typical values.

50

0

50

0

0 150 T_j (^oC)

100

1,1

0,9

_50

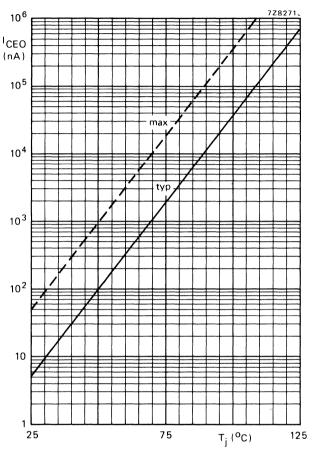
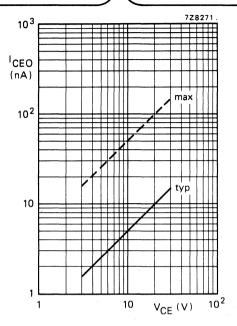


Fig. 9 $I_F = 0$; $V_{CE} = 10 \text{ V}$.



10-1 10-2 25 75 T_j (°C) 125

10²

Fig. 10 $I_F = 0$; $T_j = 25$ °C.

Fig. 11 Typical values.

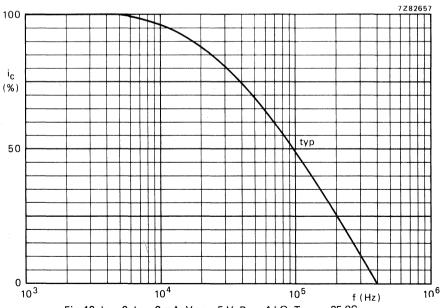


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1$ k Ω ; $T_{amb} = 25$ °C.

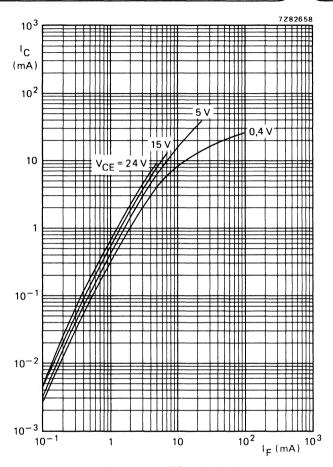


Fig. 13 $T_{amb} = 25$ °C, typical values.

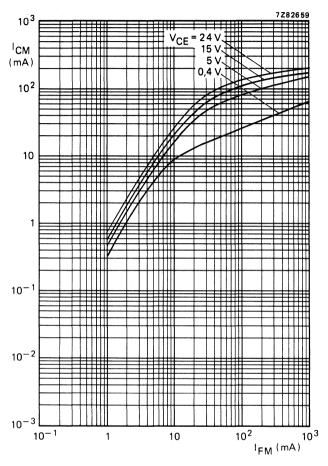


Fig. 14 T_{amb} = 25 °C; t_p = 20 μ s; T = 2 ms; typical values.

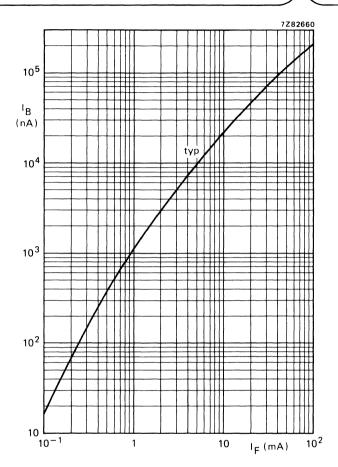


Fig. 15 $V_{CB} = 5 V$; $T_{amb} = 25 \text{ oC}$.

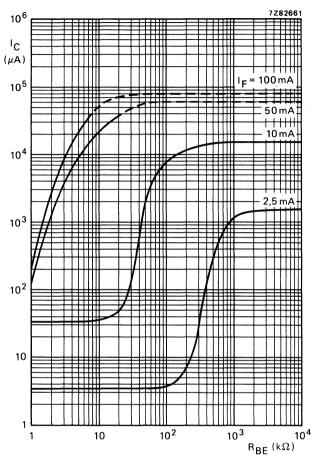


Fig. 16 $I_B = 0$; $V_{CE} = 5 V$; $T_{amb} = 25 \, {}^{o}C$; typical values.

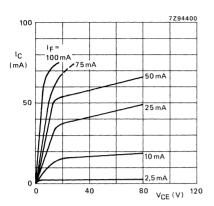


Fig. 17 $T_{amb} = 25$ °C; typical values.

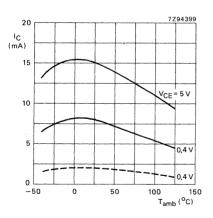


Fig. 19 I_F = 10 mA; typical values.

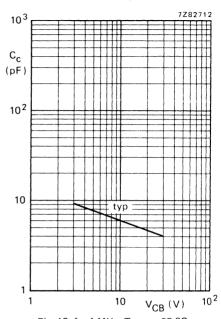


Fig. 18 f = 1 MHz; $T_{amb} = 25 \text{ oC}$.

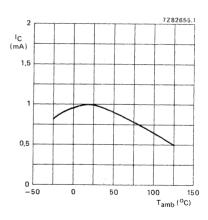


Fig. 20 I_F = 2 mA; typical values.

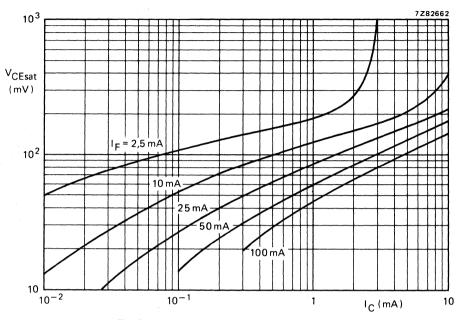


Fig. 21 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

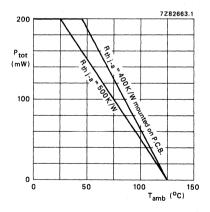


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

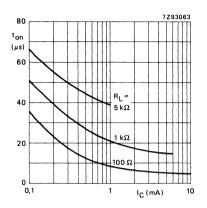


Fig. 23 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 25.)

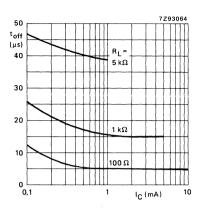
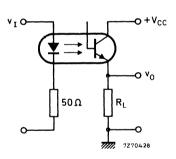


Fig. 24 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C, typical values. (See also Fig. 25.)



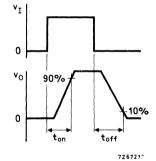


Fig. 25 Switching circuit and waveforms.



OPTOCOUPLER

Opto-isolator comprising an infrared emitting GaAs diode and a silicon n-p-n Darlington phototransistor with accessible base. Plastic 6-lead dual-in line (DIL) envelope.

Features:

- very high output/input d.c. current transfer ratio;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.)

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	٧R	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$ Total power dissipation up to $T_{amb} = 25 \ ^{\circ}C$	lF IFRM	max.	100 mA 3 A 200 mW
Transistor	P _{tot}	max.	200 IIIW
Collector-emitter voltage (open base)	VCEO	max.	30 V
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 1 mA; V _{CE} = 1 V; (I _B = 0)	IC/IF	min.	5
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV diode: I _F = 0 (see also Fig. 2)	ICEW	max.	1 μΑ
Isolation voltage (d.c.)	VIORM	min.	4,4 kV

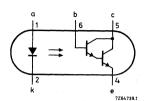
MECHANICAL DATA

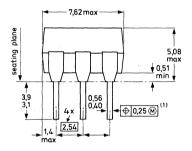
SOT-90B (see Fig. 1).

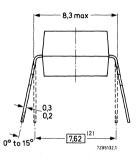
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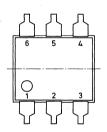
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- M Maximum material condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	· V _R	max.	5 V
Forward current			
d.c.	1F	max.	100 mA
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$	FRM	max.	3 A
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	Тj	max.	125 °C

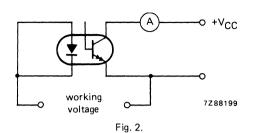
		_		
Transistor				
Collector-emitter breakdown voltage				
$I_C = 1 \text{ mA}$	V(BR)CEO	min.	30 V	
Collector-base breakdown voltage	V(BR)CBO	min.	30 V	
Emitter-collector breakdown voltage	A (BH)CRO	*******	00 1	
IE = 0,1 mA	V(BR)ECO	min.	6 V	
Collector current (d.c.)	IC	max.	100 mA	
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200 mW	
Junction temperature	Τj	max.	125 °C	
Optocoupler			•	
Storage temperature	T_{stg}	-55 to	o +150 °C	
Lead soldering temperature	-			
up to the seating plane; $t_{ m sld}$ $<$ 10 s	T _{sld}	max.	260 °C	
THERMAL RESISTANCE				
From junction to ambient in free air				
diode and transistor	R _{th j-a}	=	500 K/W	
From junction to ambient, device				
mounted on a printed-circuit board diode and transistor	R _{th i-a}	=	400 K/W	
	···tii j-a			
ISOLATION RELATED VALUES			-	
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm	
External tracking path (creepage dist)	2(101)	*******	,	
input terminals to output terminals	L(102)	min.	7,0 mm	
Tracking resistance (KB-value)		KB	-100/A	
CHARACTERISTICS				
T _i = 25 °C unless otherwise specified				
•				
Diode				
Forward voltage	VF	typ.	1,15 V	
•	- 1	max.	1,3 V	
Reverse current VR = 5 V	IR	max.	10 μΑ	
*H 3 *	'N	max	70 /27	
Transistor $(I_F = 0)$				
Collector cut-off current (dark)	loso	typ.	20 nA	
$V_{CE} = 10 V$	ICEO	max.	100 nA	
V _{CB} = 10 V	ICEO	max.	20 nA	
Collector-emitter breakdown voltage			20.17	
at I _C = 1 mA	V _(BR) CEO	min.	30 V	
Collector-base breakdown voltage				
at $I_C = 0.1 \text{ mA}$	V(BR)CBO	min.	30 V	

E. Sono and Control Employees in the con-			
Emitter-collector breakdown voltage			
at $I_E = 0.1 \text{ mA}$	V(BR)ECO	min.	7 V
Optocoupler (I _B = 0)*			
Output/input d.c. current transfer ratio (C.T.R.)			
IF = 0,5 mA; VCE = 1 V	IC/IF	min.	3,5
IF = 1,0 mA; VCE = 1 V	IC/IF	min.	5
I _F = 10 mA; V _{CE} = 1 V	IC/IF	min.	6
Collector cut-off current (dark) see Fig. 2			
V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV	¹ CEW	max.	1 μA**
$V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 2,5 kV; $T_i = 70 \text{ °C}$	CEW	max.	1000 μA**
Collector-emitter saturation voltage			
IF = 5 mA; IC = 10 mA	V _{CEsat}	max.	1 V
	0_000		
Isolation voltage A	VIORM	min.	4,4 kV (d.c.)
Collector capacitance at f = 1 MHz			3,12 kV (r.m.s.)
I _E = I _e = 0; V _{CB} = 10 V	C _{bc}	typ.	4,5 pF
Capacitance between input and output			
IF = 0: V = 0: f = 1 MHz	Cio	typ.	0,6 pF
	-10	-7.1	-,
Insulation resistance between input and output		min.	$10^{10} \Omega$
$\pm V_{1O} = 1 kV$	rio	typ.	10 ¹² Ω
Switching times (see Figs 3 and 4)			
	ton	typ.	5 μs
I_{Fon} = 10 mA; V_{CC} = 5 V; R_E = 100 Ω ; R_{BE} = 1 M Ω	toff	typ.	30 μs
	ton	typ.	50 μs
$I_{Fon} = 1 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_E = 1 \text{ k}\Omega$; $R_{BE} = 10 \text{ M}\Omega$	toff	typ.	250 μs
	0.1		•

Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

^{**} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

[▲] Tested on a sample basis with a voltage of 4400 V (d.c.) for 1 minute between the shorted input (diode) leads and the shorted output (phototransistor) leads.



V₁ O +V_{CC}

R_{BE} V₀

50 Ω R_E

Fig. 3 Switching circuit.

7Z88200

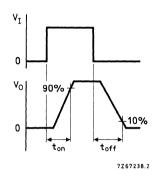


Fig. 4 Waveforms.

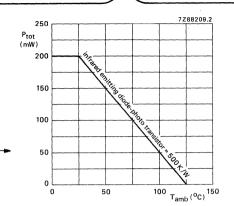


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

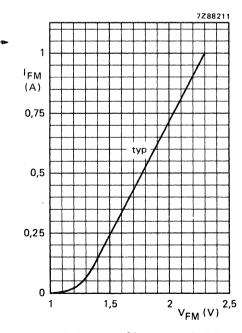
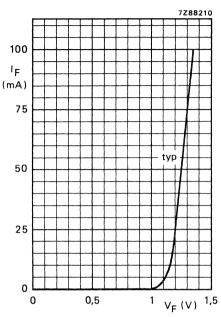


Fig. 7 $T_{amb} = 25$ °C; $t_p = 10 \,\mu s$; $\delta = 0.01$.



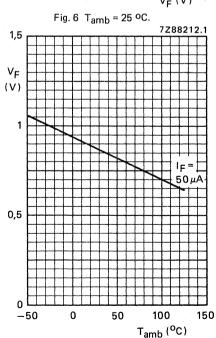


Fig. 8 Typical values.

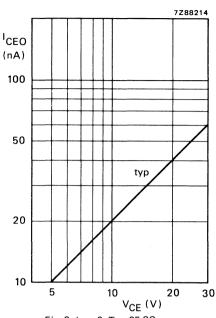


Fig. 9 1F = 0; $T_j = 25$ °C.

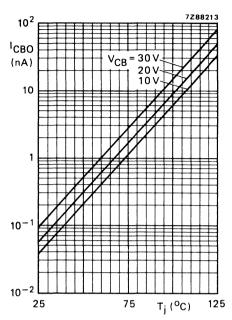


Fig. 10 Typical values.

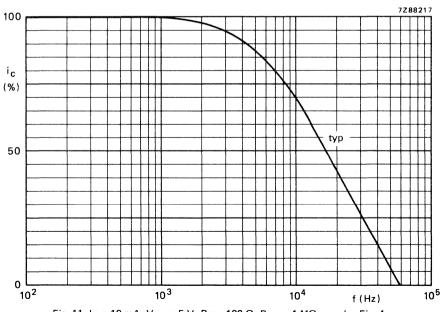


Fig. 11 I_C = 10 mA; V_{CC} = 5 V; R_E = 100 Ω ; R_{BE} = 1 M Ω ; see also Fig. 4.

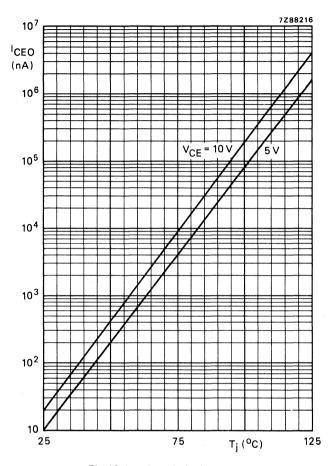


Fig. 12 $I_F = 0$; typical values.

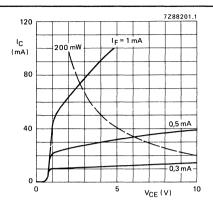


Fig. 13 Typical values; $T_{amb} = 25$ °C.

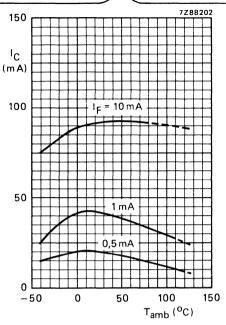
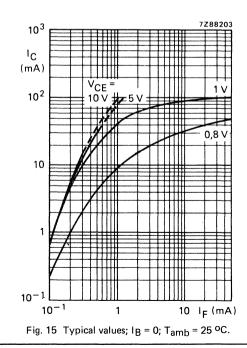


Fig. 14 Typical values; $I_B = 0$; $V_{CE} = 1 V$.



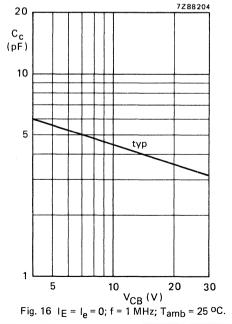
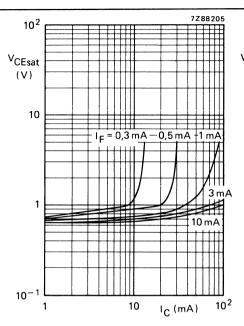


Fig. 17 $I_E = 0$; $V_{CB} = 5 V$; $T_{amb} = 25 °C$.

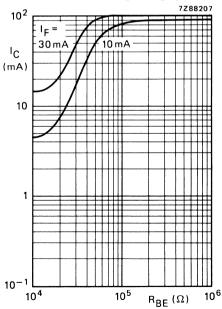
7Z88206



 V_{CEsat} (V) 1 I_C = 60 mA $I_F = 5 \, \text{mA}$ 0,5 I_C = 10 mA 0 -50 100 150 50 T_{amb} (OC) Fig. 19 Typical values; $I_B = 0$.

1,5

Fig. 18 Typical values; IB = 0; Tamb = 25 °C.



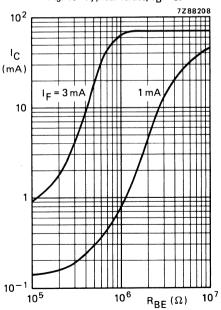


Fig. 20 Typ. values; $V_{CE} = 1 \text{ V}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

Fig. 21 Typ. values; $V_{CE} = 1 \text{ V}$, $T_{amb} = 25 \text{ °C}$.

OPTOCOUPLER

Opto-isolator comprising an infrared emitting GaAs diode and a silicon n-p-n Darlington phototransistor with accessible base. Plastic 6-lead dual-in line (DIL) envelope.

Features:

- very high output/input d.c. current transfer ratio;
- high isolation voltage of 3,12 (r.m.s.) and 4,4 kV (d.c.)
- working voltage 2,5 kV (d.c.)
 - UL Covered under UL component recognition FILE E90700
 - ${\tt VDE-Approved\ according\ to\ VDE\ 0883/6.83}$

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

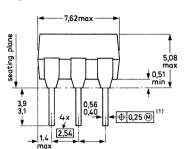
Diode				
Continuous reverse voltage	v_R	max.	5	٧
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	l _F l _{FRM}	max. max.	100 3	mA A
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V _{CEO}	max.	30	V
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200	mW
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 1 \text{ mA}$; $V_{CE} = 1 \text{ V}$; ($I_B = 0$)	I _C /I _F	min.	5	
Collector cut-off current (dark) VCC = 10 V; working voltage (d.c.) = 1,5 kV				
diode: $I_F = 0$ (see also Fig. 2)	CEW	max.	1	μΑ
Isolation voltage (d.c.)	VIORM	min.	4,4	kV

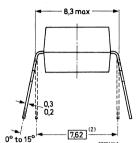
MECHANICAL DATA

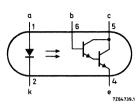
SOT-90B (see Fig. 1).

MECHANICAL DATA

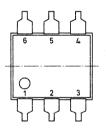
Fig. 1 SOT-90B.







Dimensions in mm



- Positional accuracy.
- Maximum material condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	٧R	max.	5 V
Forward current			
d.c.	l _F	max.	100 mA
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$!FRM	max.	3 A
Total power dissipation up to $T_{amb} = 25 ^{\circ}\text{C}$	P _{tot}	max.	200 mW
Junction temperature	T_{j}	max.	125 °C

Transistor			
Collector-emitter breakdown voltage			
I _C = 1 mA	V(BR)CEO	min.	30 V
Collector-base breakdown voltage			
$I_C = 0.1 \text{ mA}$	V(BR)CBO	min.	30 V
Emitter-collector breakdown voltage			
I _E = 0,1 mA	V(BR)ECO	min.	6 V
Collector current (d.c.)	lc	max.	100 mA
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW
Junction temperature	Τj	max.	125 °C
Optocoupler			•
Storage temperature	T_{stq}	-55 t	o +150 °C
Lead soldering temperature	3		
up to the seating plane; $t_{ m sld}$ $<$ 10 s	T_{sld}	max.	260 °C
THERMAL RESISTANCE			
From junction to ambient in free air			
diode and transistor	R _{th j-a}	=	500 K/W
From junction to ambient, device	ar, u		
mounted on a printed-circuit board			
diode and transistor	R _{th j-a}	=	400 K/W
ISOLATION RELATED VALUES			
External air gap (clearance)			
input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage dist)			
input terminals to output terminals	L(102)	min.	7,0 mm
Tracking resistance (KB-value)		KB	-100/A
CHARACTERISTICS			
T _i = 25 °C unless otherwise specified			
, Diode			
Forward voltage			
For ward vortage	VF	typ.	1,15 V
•	* 1	max.	1,3 V
Reverse current	1_		104
V _R = 5 V	IR	max.	10 μΑ
Transistor $(I_F = 0)$			
Collector cut-off current (dark)		typ.	20 nA
V _{CE} = 10 V	ICEO	max.	100 nA
V _{CB} = 10 V	ICEO	max.	20 nA
Collector omitter breakdows			
Collector-emitter breakdown voltage at I _C = 1 mA	V(BR)CEO	min.	30 V
Collector-base breakdown voltage	*(RK)CEO		30 V
·	V(BR)CBO	min.	30 V
at I _C = 0,1 mA			

Emitter-collector breakdown voltage				
at I _E = 0,1 mA	V(BR)EC	o min.	7	V
Optocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.)				
$I_F = 0.5 \text{ mA}; V_{CE} = 1 \text{ V}$	lc/l _F	min.	3,5	
I _F = 1,0 mA; V _{CE} = 1 V	IC/IF	min.	5	
I _F = 10 mA; V _{CE} = 1 V	IC/IF	min,	6	
Collector cut-off current (dark) see Fig. 2				
$V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5 kV	ICEW	max.	1	μA **
$V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5 kV; $T_i = 70 ^{\circ}\text{C}$	ICEW	max.	1000	μΑ **
Collector-emitter saturation voltage				
I _E = 5 mA; I _C = 10 mA	V _{CEsat}	max.	1	V
	0_000		44	kV(d.c.)
➤ Isolation voltage	v_{IORM}	min.	,	kV(r.m.s.)
Collector capacitance at f = 1 MHz			·	
$I_F = I_e = 0$; $V_{CR} = 10 \text{ V}$	C _{bc}	typ.	4,5	nΕ
	ODC	cyp.	.,0	ρ.
Capacitance between input and output	C -	tun	0,6	nE.
$I_F = 0$; $V = 0$; $f = 1 \text{ MHz}$	C _{io}	typ.	0,0	ρı
Insulation resistance between input and output		min.	10 ¹⁰	Ω
$\pm V_{10} = 1 \text{ kV}$	rio	typ.	10 ¹²	Ω
Switching times (see Figs 3 and 4)				
$I_{Eon} = 10 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_F = 100 \Omega$; $R_{BF} = 1 \text{ M}\Omega$	^t on	typ.		μs
.Foll 12 100 21, 11E 100 22, 11BE 1 11112	^t off	typ.	30	•
$I_{Eon} = 1 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_{E} = 1 \text{ k}\Omega$; $R_{BE} = 10 \text{ M}\Omega$	^t on	typ.	50	
TOTAL	toff	typ.	250	μs

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

^{**} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

[▲] Every single product is tested by applying an isolation test voltage of 3750 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

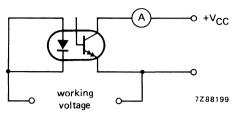


Fig. 2.

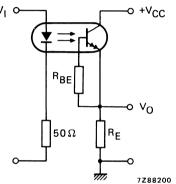


Fig. 3 Switching circuit.

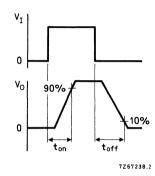


Fig. 4 Waveforms.

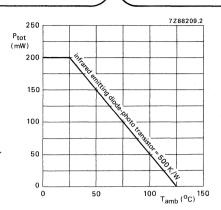


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

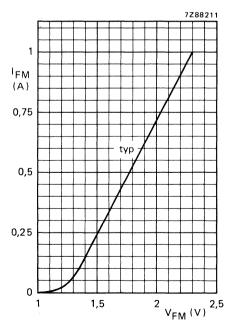
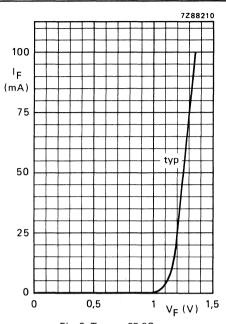


Fig. 7 $T_{amb} = 25$ °C; $t_p = 10 \,\mu s$; $\delta = 0.01$.



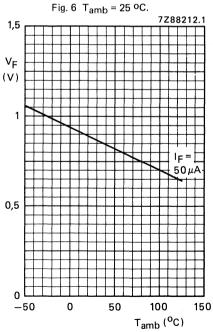
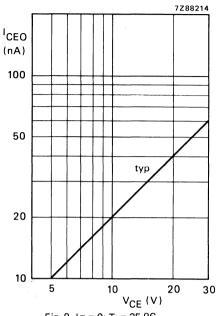


Fig. 8 Typical values.



10²
|CBO (nA) | VCB = 30 V | 10 V |

Fig. 9 $I_F = 0$; $T_j = 25$ °C.

Fig. 10 Typical values.

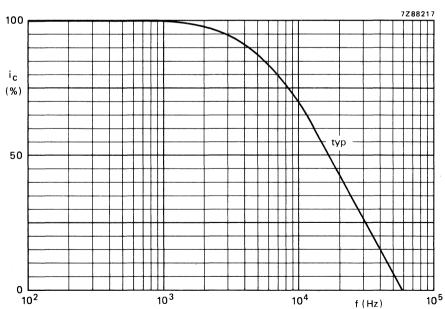


Fig. 11 I_C = 10 mA; V_{CC} = 5 V; R_E = 100 Ω ; R_{BE} = 1 M Ω ; see also Fig. 3.

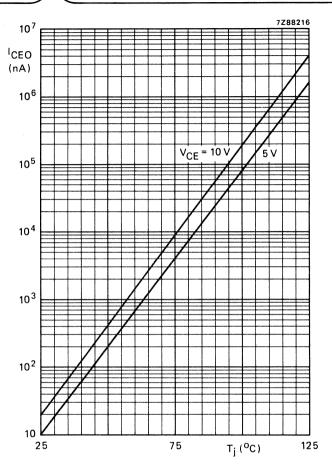


Fig. 12 $I_F = 0$; typical values.

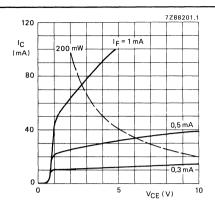


Fig. 13 Typical values; $T_{amb} = 25$ °C.

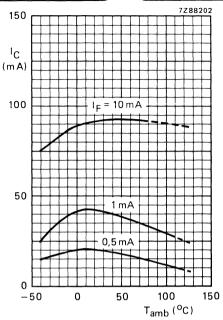


Fig. 14 Typical values; $I_B = 0$; $V_{CE} = 1 V$.

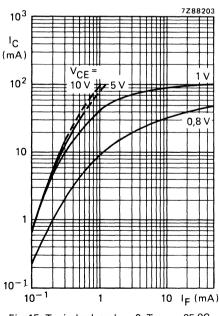


Fig. 15 Typical values; $I_B = 0$; $T_{amb} = 25$ °C.

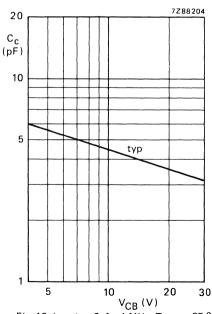


Fig. 16 $I_E = I_e = 0$; f = 1 MHz; $T_{amb} = 25 \text{ °C}$.

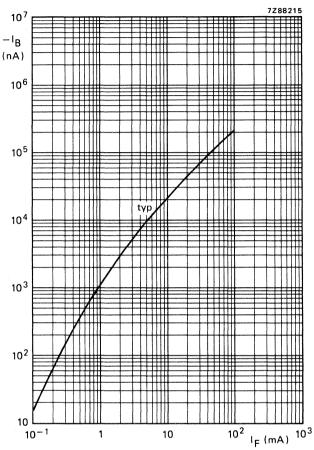


Fig. 17 $I_E = 0$; $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$.

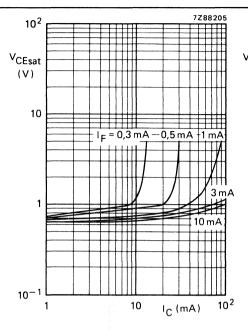


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25$ °C.

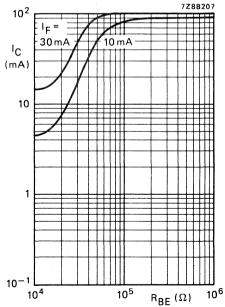


Fig. 20 Typ. values; $V_{CE} = 1 \text{ V}$; $T_{amb} = 25 \text{ °C}$.

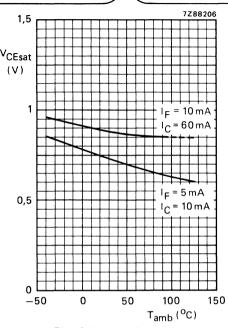


Fig. 19 Typical values; $I_B = 0$.

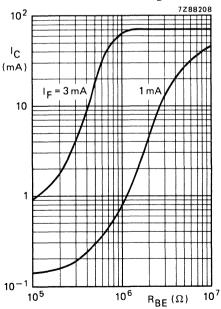


Fig. 21 Typ. values; $V_{CE} = 1 \text{ V}$; $T_{amb} = 25 \text{ }^{o}\text{C}$.



HIGH-VOLTAGE OPTOCOUPLER

The CNX62 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor in a dual-in-line (DIL) plastic envelope. The base is not connected.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of a.c. and d.c. insulation (3750 V r.m.s. and 5300 V d.c.)
- working voltage of 2,5 kV (d.c.)
 - UL Covered under UL component recognition FILE E90700
 - VDE Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

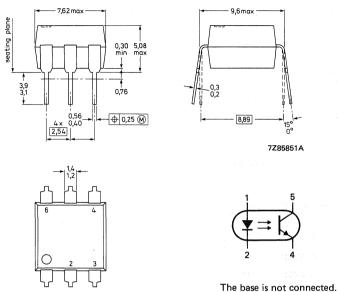
Diode			
Continuous reverse voltage	VR	max.	5 V
Forward current d.c. peak value; t_{on} = 10 μ s; δ = 0,01 Total power dissipation up to T_{amb} = 25 °C	IF IFRM P _{tot}	max. max. max.	100 mA 3 A 200 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	50 V
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	IC/IF	min.	0,4
Collector cut-off current (dark) VCC = 10 V; working voltage (d.c.) = 2,5 kV IF (diode) = 0 (see Fig. 4)	ICEW	max.	200 nA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	VCEsat	max.	0,4 V
Isolation voltage (d.c.)	VIORM	min.	5,3 kV

MECHANICAL DATA

SOT-174 (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT-174.



Dimensions in mm

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

VR	max.	5 V
۱F	max.	100 mA
IFRM	max.	3 A
P _{tot}	max.	200 mW
VCEO	max.	50 V
VECO	max.	7 V
IC	max.	100 mA
D	may	200 mW
	FFRM Ptot VCEO VECO	IF max. IFRM max. Ptot max. VCEO max. VECO max. IC max.

Optocoupler				
Storage temperature	T_{stq}	-55 t	o +150	oC
Junction temperature	T _i	max.	125	oC
Soldering temperature up to the seating plane; $t_{\mbox{sld}} < \mbox{10 s}$	T _{sld}	max.	260	oC
THERMAL RESISTANCE				
From junction to ambient in free air				
diode	R _{th j-a}	max.		K/W
transistor	R _{th j-a}	max.	500	K/W
From junction to ambient when mounted on p.c.b. diode	R.i.	max.	400	K/W
transistor	R _{th j-a} R _{th j-a}	max.		K/W
1001 ATION DEL ATER MALLIES	ar j a			
ISOLATION RELATED VALUES				
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	8.4	mm
•	L(IOI)		0,4	111111
External tracking path (creepage dist) input terminals to output terminals	L(102)	min.	7.0	mm
Tracking resistance (KB-value)	2(102)		-100/A	
•				
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage		typ.	1,15	V
IF = 10 mA	٧F	max.	1,50	
Reverse current				
$V_R = 5 V$	IR	max.	10	μΑ
Transistor				
Collector-emitter breakdown voltage				
I _C = 1 mA	V(BR)CEO	min.	50	V
Emitter-collector breakdown voltage				
IE = 0,1 mA	V(BR)ECO	min.	7	V
Collector out off ourrent (dorle), diado I = - 0		tun	2	nΑ
Collector cut-off current (dark); diode IF = 0				
VCE = 10 V	ICEO	typ. max.	50	nΑ
·	ICEO			nΑ μΑ
V _{CE} = 10 V		max.		
V _{CE} = 10 V V _{CE} = 10 V; T _{amb} = 70 °C		max. max.	10	
$V_{CE} = 10 \text{ V}$ $V_{CE} = 10 \text{ V}; T_{amb} = 70 ^{\circ}\text{C}$ Optocoupler		max. max. min.	0,4	
V_{CE} = 10 V V_{CE} = 10 V; T_{amb} = 70 °C Optocoupler Output/input d.c. current transfer ratio (C.T.R.) I_F = 10 mA; V_{CE} = 0,4 V	I _{CEO}	max. max. min. typ.	0,4 0,8	
$V_{CE} = 10 \text{ V}$ $V_{CE} = 10 \text{ V}$; $T_{amb} = 70 \text{ °C}$ Optocoupler Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$ $I_F = 10 \text{ mA}$; $V_{CE} = 5 \text{ V}$	ICEO	max. max. min.	0,4	
V_{CE} = 10 V V_{CE} = 10 V; T_{amb} = 70 °C Optocoupler Output/input d.c. current transfer ratio (C.T.R.) I_F = 10 mA; V_{CE} = 0,4 V	I _{CEO}	max. max. min. typ.	0,4 0,8 1,5	

Optocoupler (continued)

Collector-emitter saturation voltage IF = 10 mA; IC = 4 mA

Collector cut-off current (dark) at

working voltage (2,5 kV d.c.);

 $V_{CC} = 10 \text{ V}; T_J = 25 \text{ °C (see Fig. 4)}$ $V_{CC} = 10 \text{ V}; T_J = 70 \text{ °C (see Fig. 4)}$

Isolation voltage (see note 1)

Capacitance between input and output V = 0; f = 1 MHz

Insulation resistance between input and output $V_{IO} = \pm 1000 \text{ V}$

Switching times (see Figs 2 and 3)

Turn-on time

 $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$ $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$

Turn-off time

 $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$ $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$

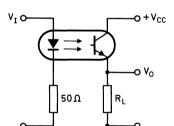
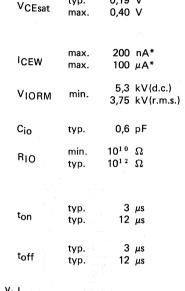


Fig. 2 Switching circuit.



tvp.

0.19 V

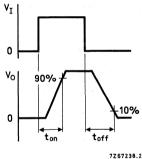


Fig. 3 Waveforms.

7Z82032.1

^{*} The two parameters are tested on a sample basis for 1000 h.

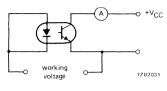


Fig. 4.

Note 1:

Every single product is tested by applying an isolation test voltage of 4500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

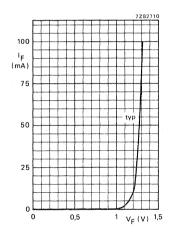


Fig. 5 Tamb = 25 °C.

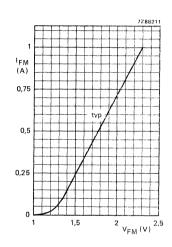


Fig. 6 $T_{amb} = 25$ °C; $t_p = 10 \,\mu s$; $\delta = 0.01$.

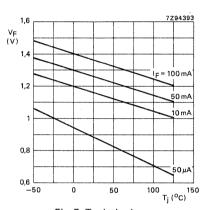


Fig. 7 Typical values.

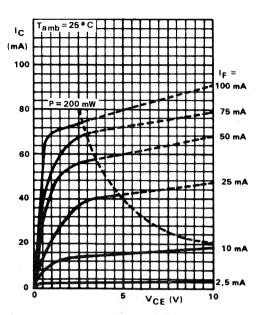


Fig. 8 Typical values.

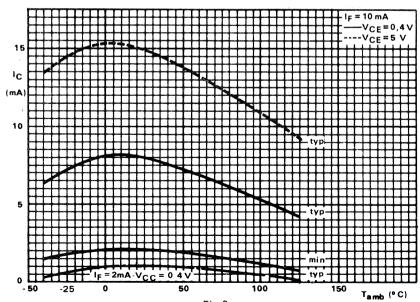


Fig. 9.

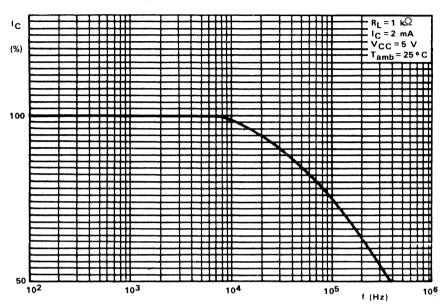
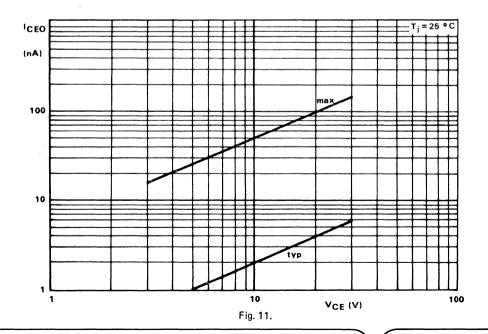


Fig. 10 Typical values.



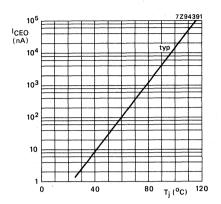


Fig. 12 $V_{CE} = 10 V$.

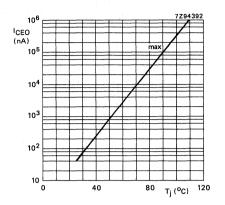


Fig. 13 $V_{CE} = 10 V$.

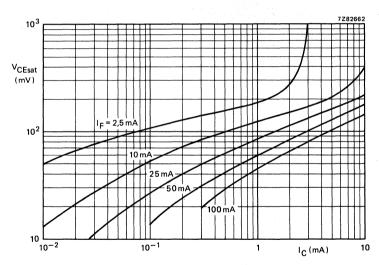


Fig. 14 T_{amb} = 25 °C; typical values.

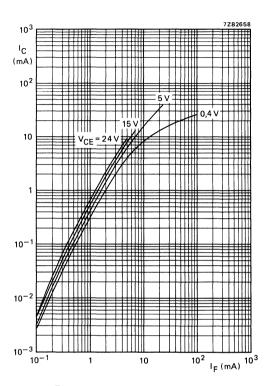


Fig. 15 $T_{amb} = 25$ °C; typical values.

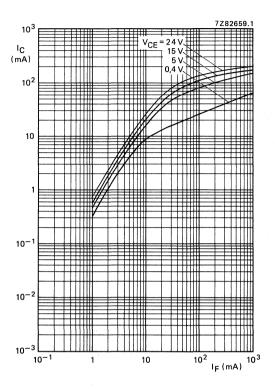


Fig. 16 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

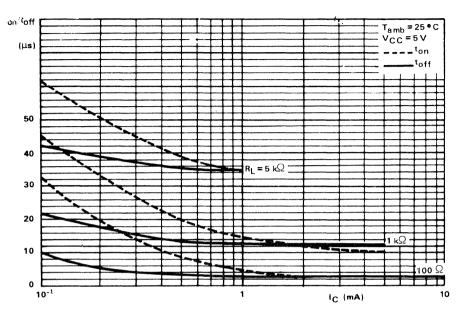


Fig. 17 Typical values.

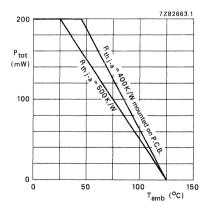


Fig. 18.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

HIGH-VOLTAGE OPTOCOUPLER

The CNX72 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor in a dual-in-line (DIL) plastic envelope.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of insulation (5300 V d.c.)
- working voltage of 2,5 kV (d.c.)
 - UL Covered under UL component recognition FILE E90700
 - VDE Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C)

DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	v_R	max.	5 V
Forward current d.c. peak value; t_{on} = 10 μ s; δ = 0,01	l _F l _{FRM}	max. max.	100 mA 3 A
Total power dissipation up to T _{amb} = 25 °C when mounted on a printed circuit board	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to T _{amb} = 25 °C when mounted on a printed circuit board	P _{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA; } V_{CE} = 0.4 \text{ V}$	IC/IF	min.	0,4
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV I _F (diode) = 0 (see Fig. 4)	ICEW	max.	200 nA
IF = 10 mA; IC = 4 mA	VCEsat	max.	0,4 V
Isolation voltage (d.c.)*	VIORM	min.	5,3 kV

MECHANICAL DATA

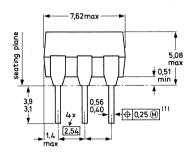
SOT-90B (see Fig. 1).

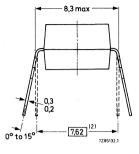
* VDE recognized: VIORM 4,4 kV d.c.

MECHANICAL DATA

Fig. 1 SOT-90B.

Dimensions in mm

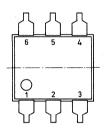






5 V

max.



- (1) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

V_R

RATINGS

Continuous reverse voltage

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

	• • • • • • • • • • • • • • • • • • • •		
Forward current d.c. peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	le Ierm	max. max.	100 mA
Total power dissipation up to T _{amb} = 25 °C when mounted on a p.c.b.	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage	V _{ECO}	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation up to $T_{amb} = 25$ °C when mounted on a p.c.b.	P _{tot}	max.	200 mW

Optocoupler				
Storage temperature	T _{sta}	-55 to	o +150	oC
Junction temperature	T _i	max.	125	
Soldering temperature	'}	max.	123	Ü
up to the seating plane; t _{sld} < 10 s	T _{sld}	max.	260	оС
	Jid			
THERMAL RESISTANCE				
From junction to ambient in free air	D .		F00	12 // 14/
diode transistor	R _{th j-a} R _{th j-a}	max. max.		K/W K/W
From junction to ambient when mounted on p.c.b.	run j-a	max.	500	12, 11
diode	R _{th i-a}	max.	400	K/W
transistor	R _{th j-a}	max.	400	K/W
ISOLATION RELATED VALUES	-			
External air gap (clearance)				
input terminals to output terminals	L(IO1)	min.	7,2	mm
External tracking path (creepage dist)				
input terminals to output terminals	L(102)	min.	7,0	mm
Tracking resistance (KB-value)		KB	-100/A	
CHARACTERISTICS				
T _i = 25 °C unless otherwise specified				
,				
Diode				
Forward voltage	\/-	typ.	1,15	V
I _F = 10 mA	VF	max.	1,50	٧
Reverse current				
V _R = 5 V	· IR	max.	10	μΑ
Transistor				
Collector-emitter breakdown voltage				
$I_C = 1 \text{ mA}$	V(BR)CEO	min.	30	V
Collector-base breakdown voltage	.,		70	
I _C = 0,1 mA	V(BR)CBO	min.	70	V
Emitter-collector breakdown voltage IF = 0,1 mA	V/00\500	min.	7	V
Collector cut-off current (dark); diode I _F = 0	V(BR)ECO	111111.	,	V
V _{CE} = 10 V	ICEO	typ.		nA
		max.		nΑ μΑ
V _{CE} = 10 V; T _{amb} = 70 °C V _{CB} = 10 V	ICEO ICBO	max. max.		μΑ nA
CB 13.1	ОВО			
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.)		min.	0,4	
$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	IC/IF	max.	1,6	
Collector-emitter saturation voltage		tvo	0,19	V
$I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	V _{CEsat}	typ. max.	0,19	
			-,	

Optocoupler (continued)

Collector cut-off (light) at T_{amb} = 0 °C to 70 °C V_F = 0,8 V; V_{CE} = 15 V I_F = 2 mA; V_{CE} = 0,4 V	CE(L)
Collector cut-off current (datk) at working voltage $V_W = 2.5 \text{ kV (d.c. value)};$ $V_{CC} = 10 \text{ V}; T_j = 25 \text{ °C (see Fig. 4)}$ $V_{CC} = 10 \text{ V}; T_j = 70 \text{ °C (see Fig. 4)}$	ICEW
$V_{CC} = 10 \text{ V; } T_j' = 70 \text{ °C (see Fig. 4)}$ Isolation voltage* (see note 1)	VIORM
Capacitance between input and output V = 0; f = 1 MHz	C _{io}
Output capacitance V _{CB} = 10 V; f = 1 MHz	C _{bc}

Insulation resistance between input and output

V₁₀ = ± 1000 V

Switching times (see Figs 2 and 3)

Turn-on time

 I_C = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω R_{BE} = 56 k Ω

Turn-off time

 $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$

 $R_{BF} = 56 k\Omega$

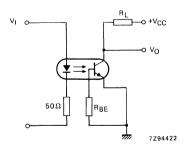
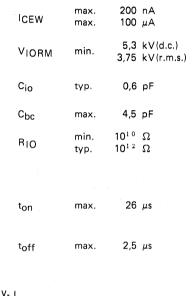


Fig. 2 Switching circuit.



max.

min.

15 µA

150 µA

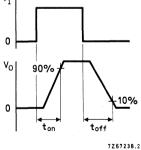


Fig. 3 Waveforms.

^{*} VDE recognized : VIORM 4,4 kV d.c.

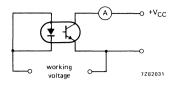


Fig. 4.

Note 1:

Every single product is tested by applying an isolation test voltage of 4500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

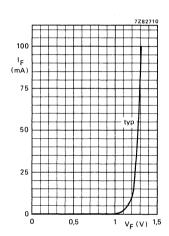


Fig. 5 $T_{amb} = 25 \text{ oC}$.

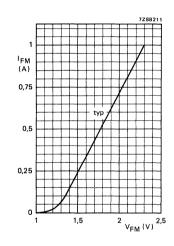


Fig. 6 $T_{amb} = 25$ °C; $t_p = 10 \ \mu s$; $\delta = 0.01$.

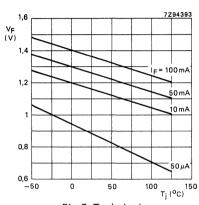


Fig. 7 Typical values.

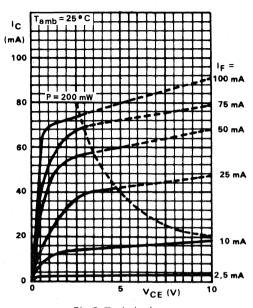
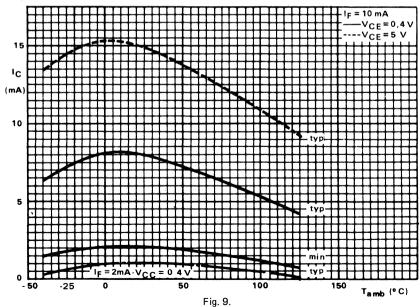
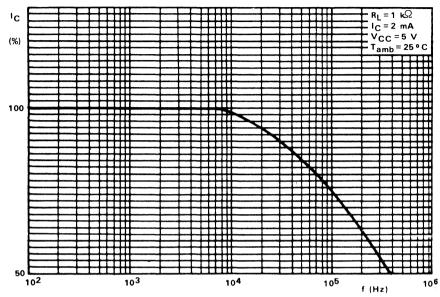


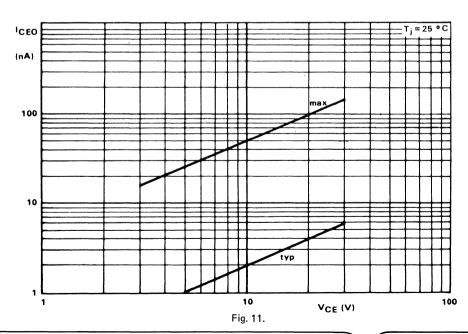
Fig. 8 Typical values.











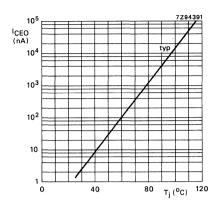


Fig. 12 $V_{CE} = 10 V$.

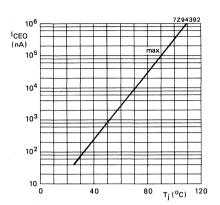


Fig. 13 $V_{CE} = 10 \text{ V}$.

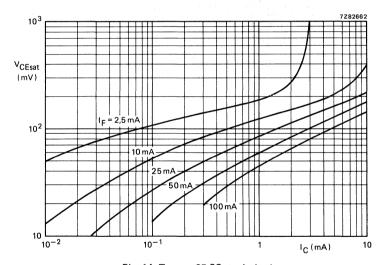


Fig. 14 T_{amb} = 25 °C; typical values.

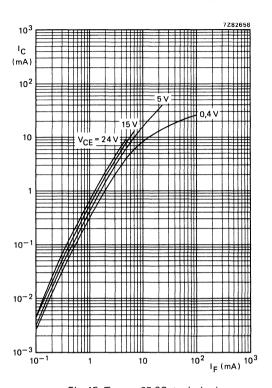


Fig. 15 $T_{amb} = 25$ °C; typical values.

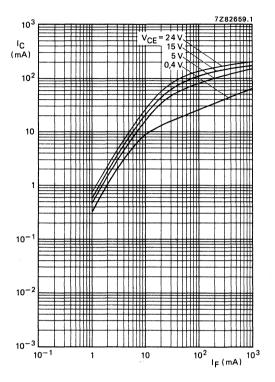


Fig. 16 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

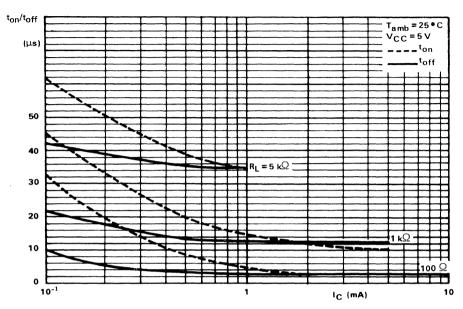


Fig. 17 Typical values.

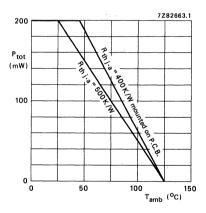


Fig. 18.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

HIGH-VOLTAGE OPTOCOUPLER

The CNX82 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor in a dual-in-line (DIL) plastic envelope. The base is not connected.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of a.c. and d.c insulation (3750 V r.m.s. and 5300 V d.c.)
- working voltage of 2.5 kV (d.c.)

UL - Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with: DIN 57 804/VDE 0804/1.83 (isolation group C)

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

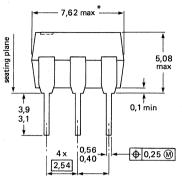
Diode			
Continuous reverse voltage	٧R	max.	5 V
Forward current d.c. peak value; $t_{OD} = 10 \ \mu s$; $\delta = 0.01$	lf lerm	max. max.	100 mA 3 A
Total power dissipation up to T _{amb} = 25 °C when mounted on a p.c.b.	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	50 V
Total power dissipation up to T _{amb} = 25 °C when mounted on a p.c.b.	P _{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 0,4 V	IC/IF	min.	0,4
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV IF (diode) = 0 (see Fig. 4)	^I CEW	max.	200 nA
Collector-emitter saturation voltage			
$I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	VCEsat	max.	0,4 V
Isolation voltage (d.c.)	v_{IORM}	min.	5,3 kV

MECHANICAL DATA

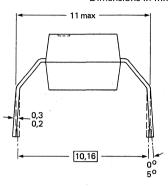
SOT-212 (see Fig. 1).

MECHANICAL DATA

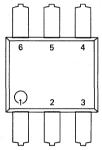
Fig. 1 SOT-212.



Dimensions in mm



7Z95606





The base is not connected.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

VR	max.	5 V
l _F lFRM	max. max.	100 mA 3 A
P _{tot}	max.	200 mW
V _{CEO}	max.	50 V
V _{ECO}	max.	7 V
IC	max.	100 mA
P _{tot}	max.	200 mW
	F FRM Ptot VCEO VECO IC	IF max. IFRM max. Ptot max. VCEO max. VECO max. IC max.

^{*} During 1986, the body length will be increased to max. 8,75 mm.

		_		
Optocoupler				
Storage temperature	T _{stq}	-55 t	o +150	oC
Junction temperature	Τi	max.	125	oC
Soldering temperature	•			
up to the seating plane; $t_{\mbox{sld}} < 10 \mbox{ s}$	T _{sld}	max.	260	oC
THERMAL RESISTANCE				
From junction to ambient in free air				
diode	R _{th j-a}	max.		K/W
transistor	R _{th j-a}	max.	500	K/W
From junction to ambient when mounted on p.c.b. diode	R _{th i-a}	max.	400	K/W
transistor	R _{th j-a}	max.		K/W
ISOLATION RELATED VALUES	, 2			
External air gap (clearance)				
input terminals to output terminals	L(IO1)	min.	9,6	mm
External tracking path (creepage dist)				
input terminals to output terminals	L(102)	min.	7,0	mm
Tracking resistance (KB-value)	v_{TR}	KB	-100/A	
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage		tun	1,15	V
IF = 10 mA	٧F	typ. max.	1,50	
Reverse current				
V _R = 5 V	۱R	max.	10	μΑ
Transistor				
Collector-emitter breakdown voltage				
IC = 1 mA	V(BR)CEO	min.	50	V
Emitter-collector breakdown voltage IF = 0,1 mA	V(BR)ECO	min.	7	V
Collector cut-off current (dark); diode I _F = 0	A (RK)ECO	,,,,,,	,	•
V _{CF} = 10 V	ICEO	typ.		nA
V _{CE} = 10 V; T _{amb} = 70 °C	ICEO	max. max.		nΑ μΑ
VCE = 10 V, Tamb = 70 -0	CEO	max.		μ
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.)	lo/le	min.	0,4	
$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	IC/IF	typ.	0,8	
IF = 10 mA; VCE = 5 V	IC/IF	typ.	1,5	
Collector cut-off current (light)	10511	may	1 =	^
$T_{amb} \le 70 {}^{\circ}\text{C}; V_F = 0.8 V; V_{CE} = 15 V$ $T_{amb} \le 70 {}^{\circ}\text{C}; I_F = 2 \text{mA}; V_{CE} = 0.4 V$	ICE(L)	max. min.	150	μA μA
amb the state of t	OL(L)	****		•

Optocoupler (continued)

Collector - emitter saturation voltage

IF = 10 mA; IC = 4 mA

Collector cut-off current (dark) at working voltage
$$V_W = 2.5 \text{ kV}$$
 (d.c. value); $V_{CC} = 10 \text{ V}$; $T_j = 25 \text{ °C}$ (see Fig. 4) * $V_{CC} = 10 \text{ V}$, $T_j = 70 \text{ °C}$ (see Fig. 4) * Isolation voltage (see note 1)

Capacitance between input and output

$$V = 0$$
; $f = 1 MHz$

Insulation resistance between input and output $V_{IO} = \pm 1000 \text{ V}$

Turn-on time

$$I_C$$
 = 2 mA; V_{CC} = 5 V; R_L = 100 Ω
 I_C = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω

Turn-off time

$$I_C = 2 \text{ mA}$$
; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$

$$I_C = 2 \text{ mA}$$
; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$

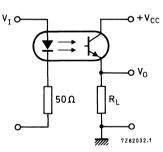
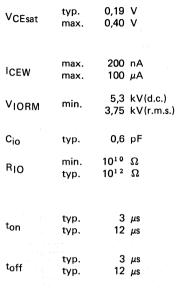


Fig. 2 Switching circuit.



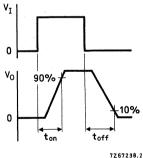


Fig. 3 Waveforms.

^{*} The two parameters are tested on a sample basis for 1000 h.

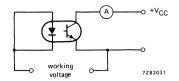


Fig. 4.

Note 1:

Every single product is tested by applying an isolation test voltage of 4500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

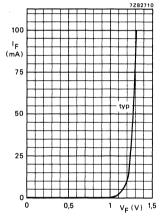


Fig. 5 T_{amb} = 25 °C.

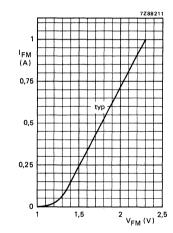


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01.

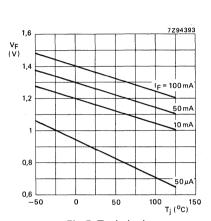


Fig. 7 Typical values.

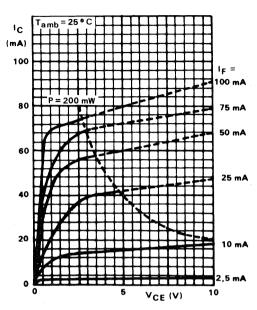
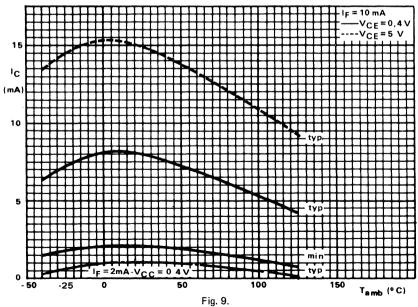


Fig. 8 Typical values.





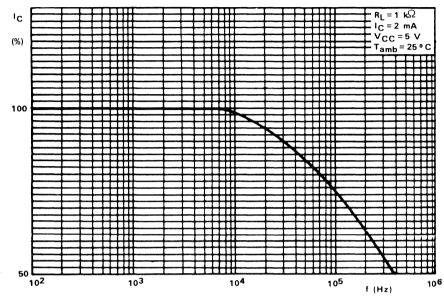
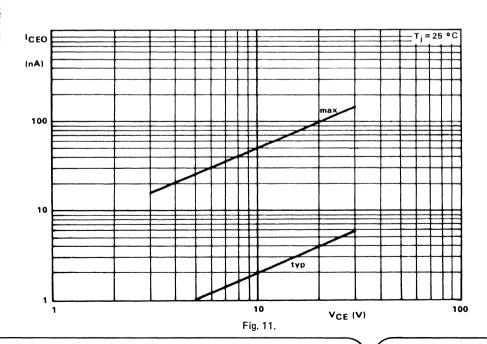


Fig. 10 Typical values.



July 1986

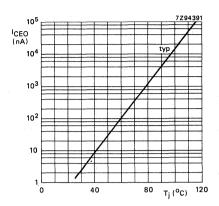


Fig. 12 $V_{CE} = 10 V$.

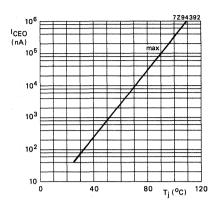


Fig. 13 $V_{CE} = 10 V$.

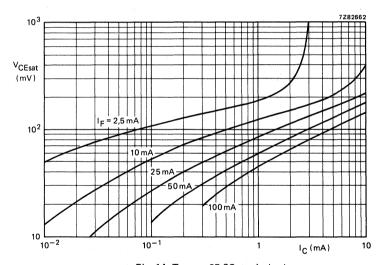


Fig. 14 $T_{amb} = 25$ °C; typical values.

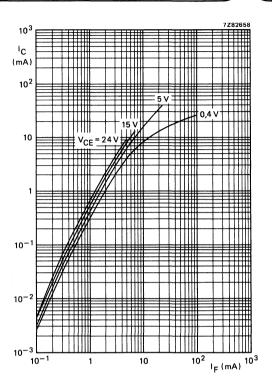


Fig. 15 $T_{amb} = 25$ °C; typical values.

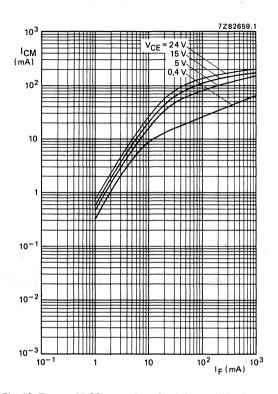


Fig. 16 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

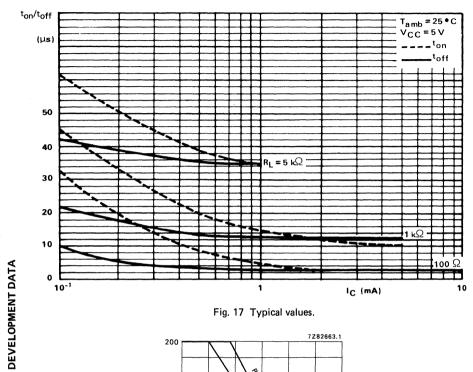


Fig. 17 Typical values.

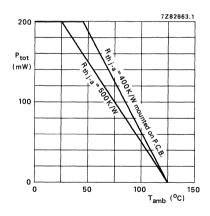


Fig. 18.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

HIGH-VOLTAGE OPTOCOUPLER

The CNX83 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor in a dual-in-line (DIL) plastic envelope. The device is derived from the CNX82 but has the base connected.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of a.c. and d.c. insulation (3750 V r.m.s. and 5300 V d.c.)
- working voltage of 2,5 kV (d.c.)

Requests for UL recognition and VDE approval are pending.

QUICK REFERENCE DATA

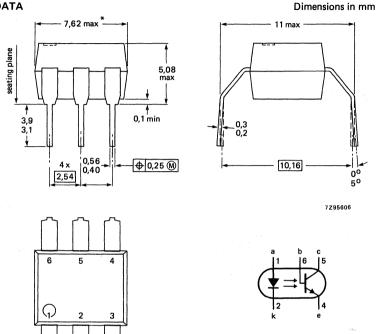
Diode			
Continuous reverse voltage	v _R	max.	5 V
Forward current d.c. peak value; $t_{on} = 10 \ \mu s$; $\delta = 0.01$	lF IFRM	max. max.	100 mA 3 A
Total power dissipation up to $T_{amb} = 25$ °C when mounted on a p.c.b.	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	50 V
Total power dissipation up to T _{amb} = 25 °C when mounted on a p.c.b.	P _{tot}	max.	200 mW
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 4 V	IC/IF	min.	0,4
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV IF (diode) = 0 (see Fig. 4)	ICEW	max.	200 nA
Collector-emitter saturation voltage			
$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$	VCEsat	max.	0,4 V
Isolation voltage (d.c.)	VIORM	min.	5,3 kV

MECHANICAL DATA

SOT-212 (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT-212.



* During 1986, the body length will be increased to max. 8,75 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	VR	max.	5 V
Forward current			
d.c.	lF	max.	100 mA
peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3 A
Total power dissipation up to Tamb = 25 °C			
when mounted on a p.c.b.	P _{tot}	max.	200 mW
Transistor			
Collector-base voltage (open emitter)	V _{СВО}	max.	70 V
Collector-emitter voltage (open base)	VCEO	max.	50 V
Emitter-collector voltage	V _{ECO}	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation up to Tamb = 25 °C			
when mounted on a p.c.b.	P _{tot}	max.	200 mW

		_		
Optocoupler				
Storage temperature	T_{stq}	-55 to	o +150	оС
Junction temperature	т _ј	max.	125	oC
Soldering temperature up to the seating plane; $t_{\mbox{sld}} < 10 \mbox{ s}$	T_{sld}	max.	260	oC
THERMAL RESISTANCE				
From junction to ambient in free air diode transistor	R _{th j-a} R _{th j-a}	max. max.	500 500	K/W K/W
From junction to ambient when mounted on p.c.b. diode transistor	R _{th j-a} R _{th j-a}	max. max.		K/W K/W
ISOLATION RELATED VALUES				
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	9,6	mm
External tracking path (creepage dist) input terminals to output terminals	L(102)	min.	7,0	mm
Tracking resistance (KB-value)		KB-100/A		
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage I _F = 10 mA	VF	typ. max.	1,15 1,50	
Reverse current V _R = 5 V	I _R	max.	10	μΑ
Transistor				
Collector-emitter breakdown voltage I C = 1 mA	V(BR)CEO	min.	50	V
Emitter-collector breakdown voltage I _E = 0,1 mA	V _{(BR)ECO}	min.	, 7	٧
Collector-base breakdown voltage at $I_C = 0.1 \text{ mA}$	V _(BR) CBO	min.	70	V
Collector cut-off current (dark); diode I _F = 0 V _{CE} = 10 V	ICEO	typ. max.	2 50	nA nA
V _{CE} = 10 V; T _{amb} = 70 °C	ICEO	max.	10	
V _{CB} = 10 V; T _{amb} = 25 °C	ГСВО	max.	20	nA
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 0,4 V	IC/IF	min. typ.	0,4 0,8	
I _F = 10 mA; V _{CE} = 5 V	IC/IF	typ.	1,5	

Optocoupler (continued)

Collector cut-off current (light) $T_{amb} \le 70 \text{ °C; V}_F = 0.8 \text{ V; V}_{CE} = 15 \text{ V}$ $T_{amb} \le 70 \text{ °C; I}_F = 2 \text{ mA; V}_{CE} = 0.4 \text{ V}$	ICE(L)		
Collector-emitter saturation voltage			
I _F = 10 mA; I _C = 4 mA	VCEsat	typ. max.	0,19 V 0,40 V
Collector cut-off current (dark) at working voltage $V_W = 2.5 \text{ kV (d.c. value)};$ $V_{CC} = 10 \text{ V}; T_j = 25 \text{ °C (see Fig. 4)}$ $V_{CC} = 10 \text{ V}, T_j = 70 \text{ °C (see Fig. 4)}$	ICEW	max. max.	200 nA* 100 μA*
Isolation voltage (see note 1)	VIORM	max.	5,3 kV(d.c.) 3,75 kV(r.m.s.)
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10 V$	C _{bc}	typ.	4,5 pF
Capacitance between input and output V = 0; f = 1 MHz	C _{io}	typ.	0,6 pF
Insulation resistance between input and output $V_{10} = \pm 1000 \text{ V}$	R _{IO}	min. typ.	$10^{10} \Omega$ $10^{12} \Omega$
Switching times (see Figs 2 and 3)			
Turn-on time $I_C = 2 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 100 \Omega$ $I_C = 2 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 1 \text{ k}\Omega$	ton	typ.	3 μs 12 μs
Turn-off time $I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$ $I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$	^t off	typ. typ.	3 μs 12 μs

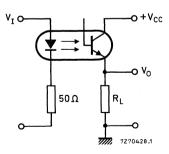


Fig. 2 Switching circuit.

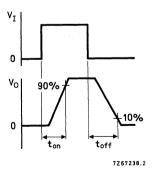


Fig. 3 Waveforms.

^{*} The two parameters are tested on a sample basis for 1000 h.

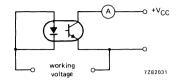


Fig. 4.

Note 1:

Every single product is tested by applying an isolation test voltage of 4500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

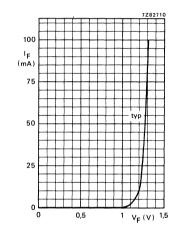


Fig. 5 T_{amb} = 25 °C.

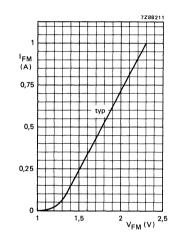


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01.

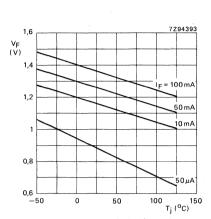


Fig. 7 Typical values.

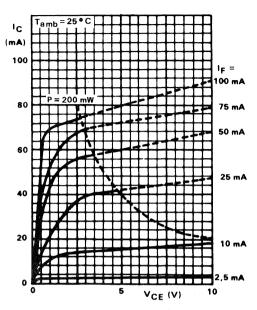


Fig. 8 Typical values.

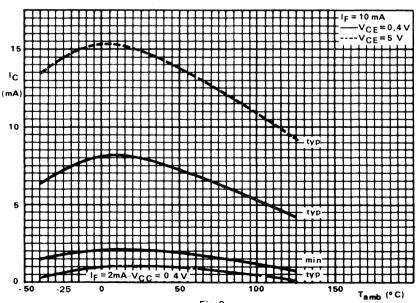


Fig. 9.



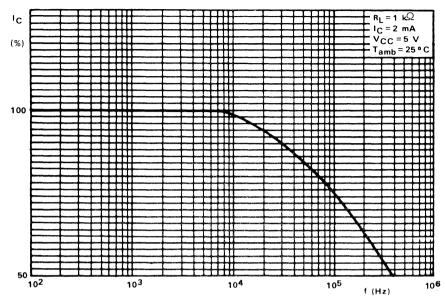
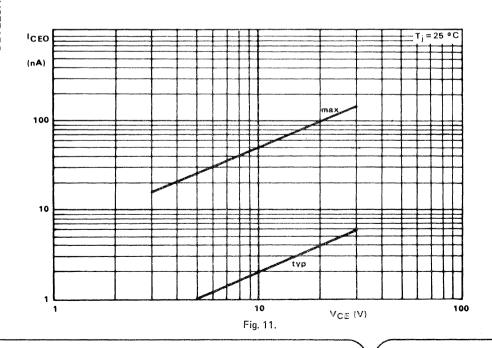


Fig. 10 Typical values.



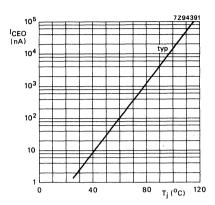


Fig. 12 $V_{CE} = 10 V$.

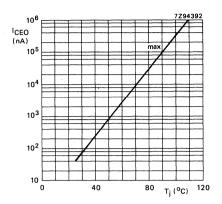


Fig. 13 V_{CE} = 10 V.

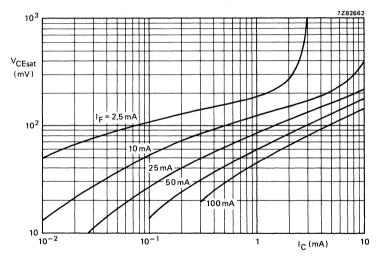


Fig. 14 $T_{amb} = 25$ °C; typical values.

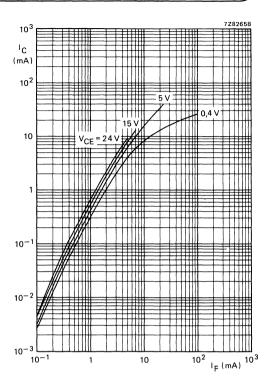


Fig. 15 $T_{amb} = 25$ °C; typical values.

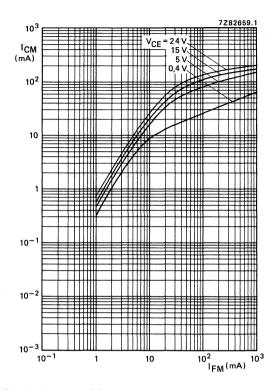


Fig. 16 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.



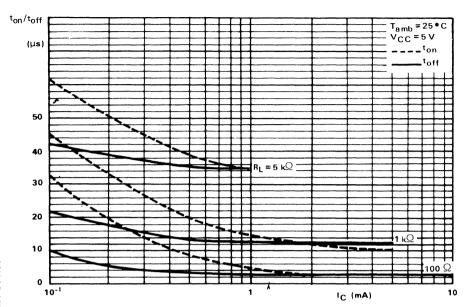


Fig. 17 Typical values.

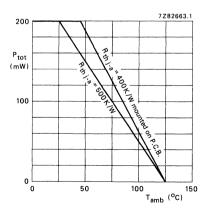


Fig. 18.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.)

QUICK REFERENCE DATA

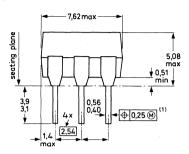
Diode				
Continuous reverse voltage		VR	max.	5 V
Forward current				
d.c.		lF.	max.	100 mA
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$		IFRM	max.	3 A
Total power dissipation up to T _{amb} = 25 °C		P _{tot}	max.	200 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25$ °C		P_{tot}	max.	200 mW
Photocoupler				
Output/input d.c. current transfer ratio (C.T.R.)	CNY57	IC/IE	min.	0,2
$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}; (I_B = 0)$	CNY57A	IC/IF	min.	0,4
Collector cut-off current (dark)				
V_{CC} = 10 V; working voltage (d.c.) = 2,5 kV				
diode: $I_F = 0$ (see also Fig. 2)		ICEW	max.	200 nA
Isolation voltage (d.c.)		VIORM	min.	4,4 kV

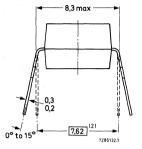
MECHANICAL DATA

SOT-90B (see Fig. 1).

MECHANICAL DATA

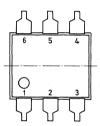
Fig. 1 SOT-90B.







Dimensions in mm



- Positional accuracy.
- M Maximum material condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

Ptot

Τj

200 mW

125 °C

max.

max.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_{R}	max.	5 V
Forward current			
d.c.	l _F	max.	100 mA
(peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	^I FRM	max.	3 A
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW
Operating junction temperature	T_{j}	max.	125 °C
Transistor			
Collector-emitter voltage (open base)	v_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	70 V
Emitter-collector voltage (open base)	VECO	max.	7 V
Collector current (d.c.)	IC	max.	100 mA

Operating junction temperature

Total power dissipation up to T_{amb} = 25 °C

Optocoupler				
Storage temperature		T_{stg}	-55 to	+150 °C
Lead soldering temperature		-		
up to the seating plane; $t_{ m sld}$ $<$ 10 s		T_{sld}	max.	260 °C
THERMAL RESISTANCE				
From junction to ambient in free air				
diode		R _{th j-a}	=	500 K/W
transistor		R _{th j-a}	=	500 K/W
From junction to ambient, device				
mounted on a printed-circuit board diode		R _{th i-a}	=	400 K/W
transistor		R _{th j-a}	= , '	400 K/W
		ar j u		
ISOLATION RELATED VALUES				
External air gap (clearance) input terminals to output terminals		L(IO1)	min.	7,2 mm
External tracking path (creepage dist)		. (100)		7.0
input terminals to output terminals		L(102)	min.	7,0 mm
Tracking resistance (KB-value)			KB-	100/A
CHARACTERISTICS				
$T_j = 25$ °C unless otherwise specified				
Diode				
Forward voltage				1 15 1/
IF = 10 mA		٧F	typ.	1,15 V 1,5 V
Reverse current				.,
V _R = 5 V		l _B	< 1	10 μΑ
n o i		11		
Transistor (diode: IF = 0)				
Collector cut-off current (dark)			typ.	2 nA
V _{CE} = 10 V		ICEO	τ γ ρ.	50 nA
V _{CE} = 10 V; T _{amb} = 70 °C		ICEO	<	10 μΑ
V _{CB} = 10 V		СВО	<	20 nA
Optocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.)				
IF = 10 mA; VCE = 0,4 V	CNY57	IC/IF		to 0,8
<u></u>			typ.	0,5
	CNY57A	IC/IF	> tvn	0,4
	-	J. 1	typ.	1

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Collector cut-off current (dark) see Fig. 2 V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV; T _i = 70 °C	ICEW ICEW	< < <	20	00	nΑ μΑ
	OL.		CNY57	CNY57	•
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$	V _{(BR)CEO}	min.	30	30	- V
Collector-base breakdown voltage IC = 0,1 mA	V(BR)CBO	min.	70	70	V
Emitter-collector breakdown voltage $I_E = 0,1 \text{ mA}$	V(BR)ECO	min.	7	7	v ¹
I _F = 10 mA; I _C = 2 mA	VCEsat	typ.	0,15 0,4	-	-
$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$	VCEsat	typ.	·	0,19	
Isolation voltage* Capacitance between input and output	VIORM	min.	4,4 3,12		kV (d.c.) kV (r.m.s
IF = 0; V = 0; f = 1 MHz	Cio	typ.	0,6	0,6	pF
Output capacitance at F = 1 MHz V _{CB} = 10 V	C _{bc}	typ.	4,5	4,5	pF
Insulation resistance between input and output ± V ₁₀ = 1 kV	rio	> typ.	10 ^{1 0} 10 ^{1 2}	10 ¹⁰ 10 ¹²	
Switching times (see Figs 3 and 4) $I_{Con} = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$					
Turn-on time Turn-off time	t _{on} t _{off}	typ. typ.	3	_	μs μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω Turn-on time Turn-off time	t _{on} t _{off}	typ.			μs μs

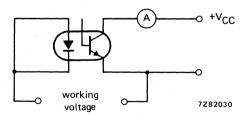


Fig. 2.

 $^{^{*}}$ Tested on a sample basis with a voltage of 4400 V (d.c.) for 1 minute between the shorted input (diode) leads and the shorted output (phototransistor) leads.

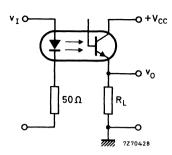


Fig. 3 Switching circuit.

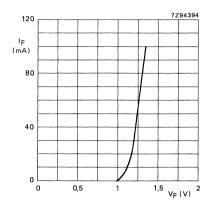


Fig. 5 T_{amb} = 25 °C; typical values.

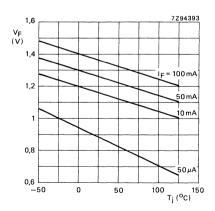


Fig. 7 Typical values.

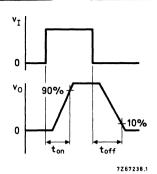


Fig. 4 Waveforms.

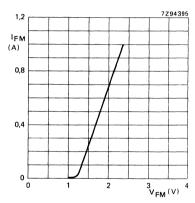


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

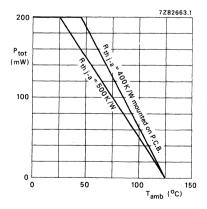


Fig. 8

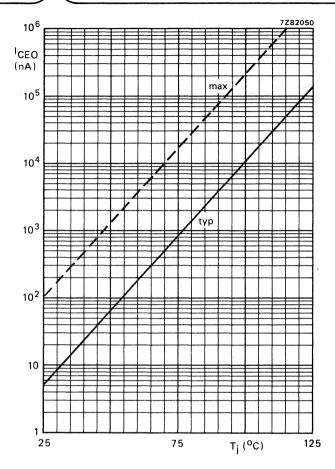
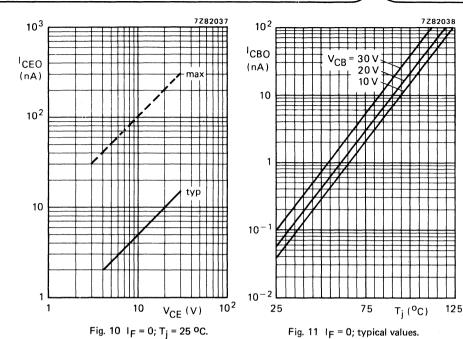
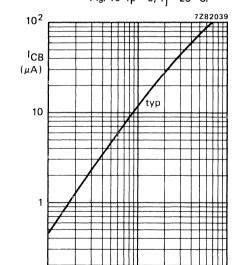


Fig. 9 $I_F = 0$; $V_{CE} = 10 \text{ V}$.





10 Fig. 12 $I_E = 0$; $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$.

10²

IF (mA)

 10^{-1}

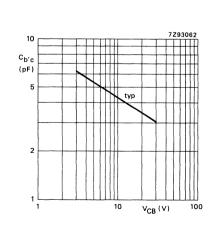


Fig. 13 f = 1 MHz.

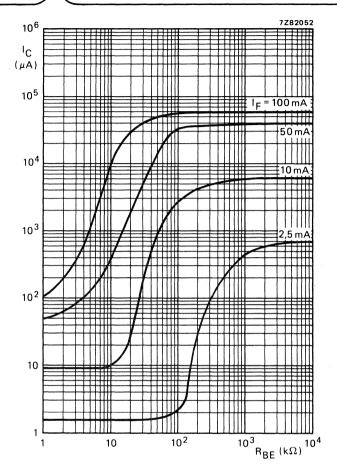


Fig. 14 CNY57; $I_{B} = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

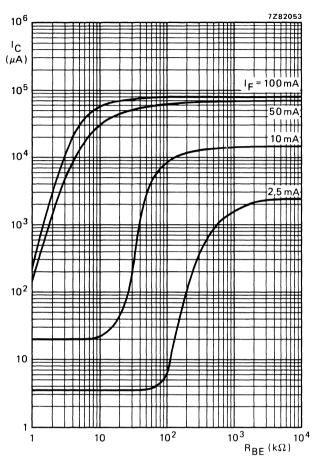


Fig. 15 CNY57A; $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

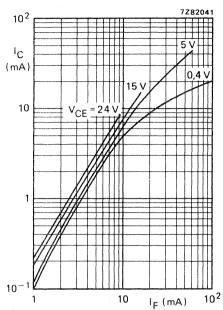


Fig. 16 CNY57; $T_{amb} = 25$ °C; typical values.

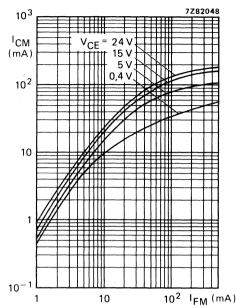


Fig. 17 CNY57A; T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

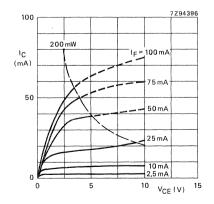


Fig. 18 CNY57; $T_{amb} = 25$ °C; typical values.

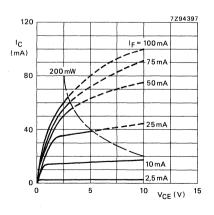


Fig. 19 CNY57A; $T_{amb} = 25$ °C; typical values.

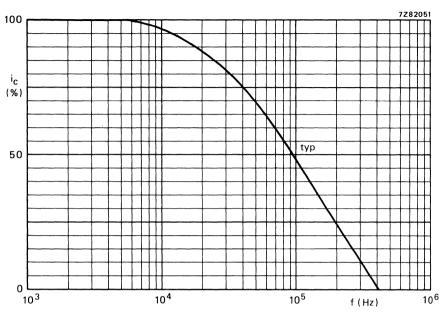
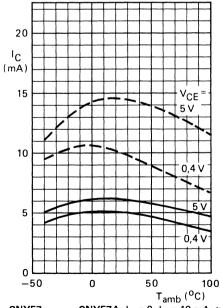


Fig. 20 I_B = 0; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω ; T_{amb} = 25 °C.



 T_{amb} (°C) Fig. 21 —— CNY57; — — CNY57A; I_B = 0; I_F = 10 mA; typical values.

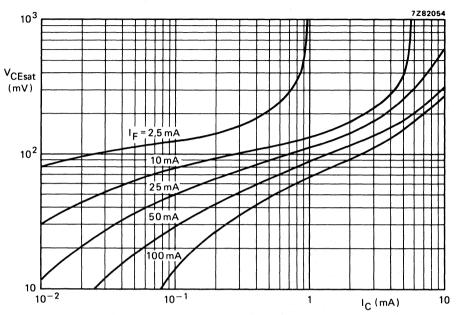


Fig. 22 CNY57; $I_B = 0$; $T_{amb} = 25$ °C; typical values.

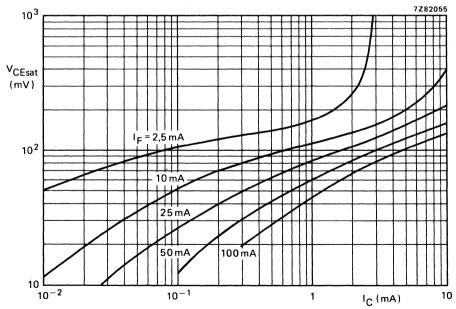


Fig. 23 CNY57A; $I_B = 0$; $T_{amb} = 25$ °C; typical values.

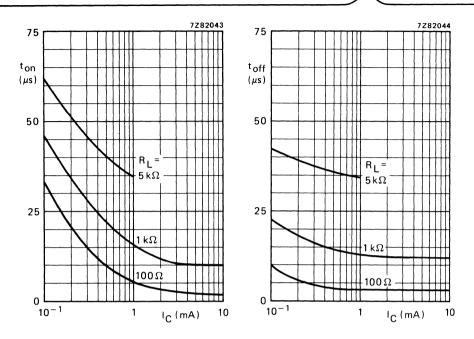


Fig. 24 CNY57; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; Fig. 25 CNY57; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 26.)

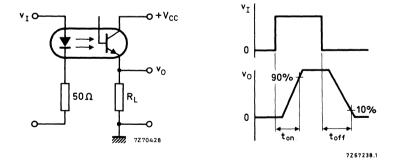
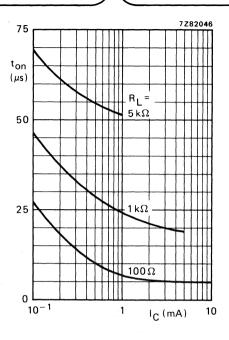


Fig. 26 Switching circuit and waveforms.



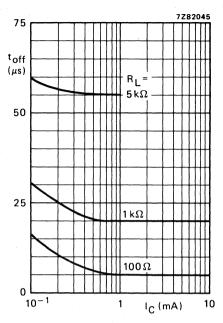
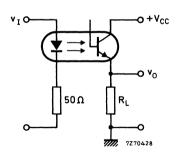


Fig. 27 CNY57A; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 29.)

Fig. 28 CNY57A; $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values. (See also Fig. 29.)



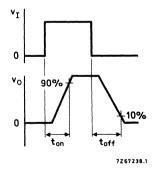


Fig. 29 Switching circuit and waveforms.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these produts:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3,12 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 2,5 kV (d.c.).

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

QUICK REFERENCE DATA

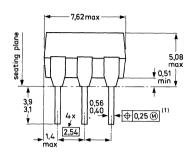
Diode					
Continuous reverse voltage		V_{R}	max.	5	٧
Forward current d.c.		1-	may	100	mΑ
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$		I _F IFRM	max. max.		A
Total power dissipation up to $T_{amb} = 25$ °C		P_{tot}	max.	200	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	30	٧
Total power dissipation up to $T_{amb} = 25$ °C		P _{tot}	max.	200	mW
Optocoupler					
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; ($I_B = 0$)	CNY57U CNY57AU	IC/IF	min. min.	0,2 0,4	
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV					
diode: $I_F = 0$ (see also Fig. 2)		CEW	max.	200	nA
Isolation võltage (d.c.)		v_{IORM}	min.	4,4	kV

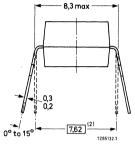
MECHANICAL DATA

SOT-90B (see Fig. 1).

MECHANICAL DATA

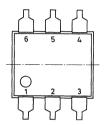
Fig. 1 SOT-90B.







Dimensions in mm



- Positional accuracy.
- Maximum material condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

 T_{j}

125 °C

max.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	v_R	max.	5 V
Forward current			
d.c.	۱F	max.	100 mA
(peak value); $t_p = 10 \ \mu s; \ \delta = 0.01$	^I FRM	max.	3 A
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_{j}	max.	125 °C
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	30 V
Collector-base voltage (open emitter)	$v_{\sf CBO}$	max.	70 V
Emitter-collector voltage (open base)	V _{ECO}	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	200 mW

Operating junction temperature

Photocoupler				
Storage temperature		T _{stg}	-55 t	o +150 °C
Lead soldering temperature				
up to the seating plane; $t_{ m sld}$ $<$ 10 s		T_{sld}	max.	260 °C
THERMAL RESISTANCE				
From junction to ambient in free air				
diode		R _{th j-a}	=	500 K/W
transistor		R _{th j-a}	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board				
diode		R _{th i-a}	=	400 K/W
transistor		R _{th j-a}	=	400 K/W
		ar j u		,
ISOLATION RELATED VALUES				
External air gap (clearance) input terminals to output terminals		L(IO1)	min.	7,2 mm
· ·		L(IOI)	111111.	7,2 11111
External tracking path (creepage dist) input terminals to output terminals		L(102)	min.	7,0 mm
Tracking resistance (KB-value)		L(102)		-100/A
Tracking resistance (ND-value)			KD	-100/A
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage				1 15 17
IF = 10 mA		٧F	typ.	1,15 V 1,5 V
Reverse current				1,5 V
VR = 5 V		1 _R	<	10 μΑ
· n		'n		10 μπ
Transistor (diode: $I_F = 0$)				
Collector cut-off current (dark)			41.45	2 nA
V _{CE} = 10 V		ICEO	typ. <	50 nA
V _{CF} = 10 V; T _{amb} = 70 °C		ICEO	<	10 μA
V _{CB} = 10 V		ICBO	<	20 nA
Photocoupler (I _B = 0)*				
Output/input d.c. current transfer ratio (C.T.R.)				
I _F = 10 mA; V _{CE} = 0,4 V	CNY57U	IC/IF	-	to 0,8
, 62 ,		J. 1	typ.	0,5
	CNY57AU	Ic/IE	>	0,4
		O-1	typ.	1

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

CNY57U CNY57AU

Collector cut-off current (dark) see Fig. 2 V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV V _{CC} = 10 V; working voltage (d.c.) = 2,5 kV;	ICEW	<	20	00 , .	nA
$T_i = 70 ^{\circ}\text{C}$	^I CEW	<	- 10	00	μΑ
•			CNY57U	CNY57AU	
Collector-emitter breakdown voltage I _C = 1 mA	V _{(BR)CEO}	min.	30	30	v
Collector-base breakdown voltage $I_C = 0.1 \text{ mA}$	V _{(BR)CBO}	min.	70	70	V
Emitter-collector breakdown voltage I _E = 0,1 mA	V _{(BR)ECO}	min.	7	7	V
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 2 \text{ mA}$	V _{CEsat}	typ.	0,15 0,4		V V
I _F = 10 mA; I _C = 4 mA	v_{CEsat}	typ.	_	0,19 0,4	
Isolation voltage*	v_{IORM}	min.	4,4 3,12		kV(d.c.) kV(r.m.s.)
Capacitance between input and output I _F = 0; V = 0; f = 1 MHz	C _{io}	typ.	0,6	0,6	pF
Output capacitance at F = 1 MHz V _{CB} = 10 V	C _{bc}	typ.	4,5	4,5	pF
Insulation resistance between input and output $\pm V_{10} = 1 \text{ kV}$	r _{IO}	> typ.	10 ¹⁰ 10 ¹²	10 ¹⁰ 10 ¹²	
Switching times (see Figs 3 and 4) $I_{Con} = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$		*:			
Turn-on time Turn-off time	^t on ^t off	typ.	3 3	1	μs μs
$I_{Con} = 4 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$ Turn-on time	t _{on}	typ.	_		μs
Turn-off time	^t off	typ.	_	5	μs

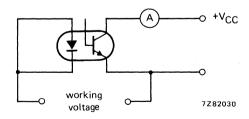


Fig. 2.

^{*} Every single product is tested by applying an isolation test voltage of 3750 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

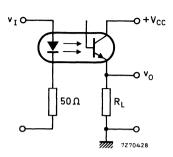


Fig. 3 Switching circuit.

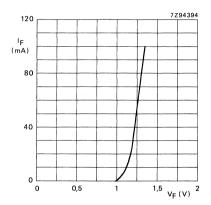


Fig. 5 $T_{amb} = 25$ °C; typical values.

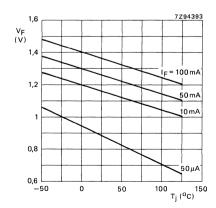


Fig. 7 Typical values.

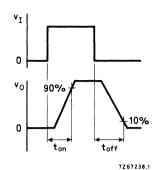


Fig. 4 Waveforms.

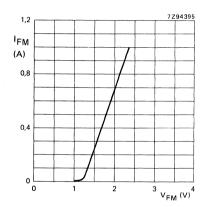


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

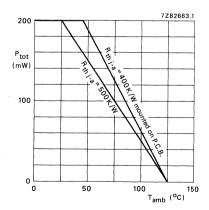


Fig. 8

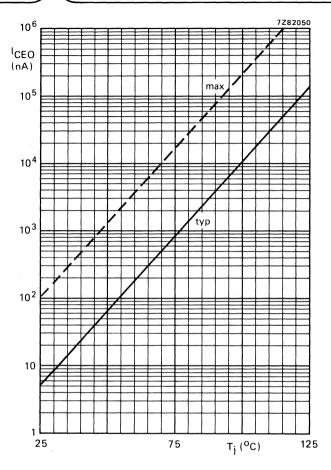


Fig. 9 $I_F = 0$; $V_{CE} = 10 \text{ V}$.

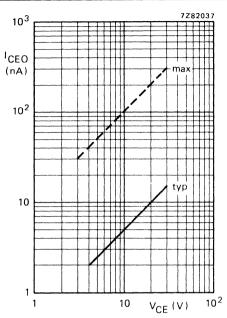


Fig. 10 $I_F = 0$; $T_i = 25$ °C.

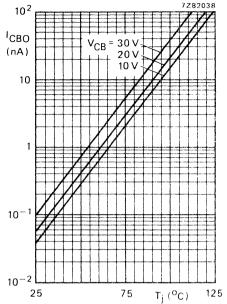


Fig. 11 IF = 0; typical values.

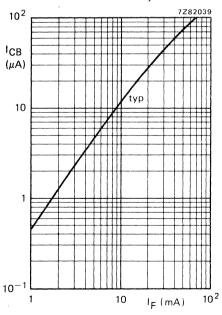


Fig. 12 $I_E = 0$; $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$.

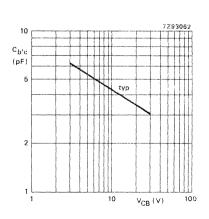


Fig. 13 f = 1 MHz.

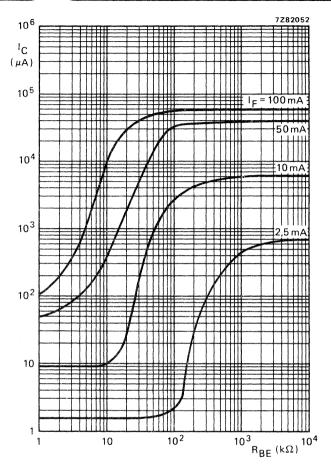


Fig. 14 CNY57U; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

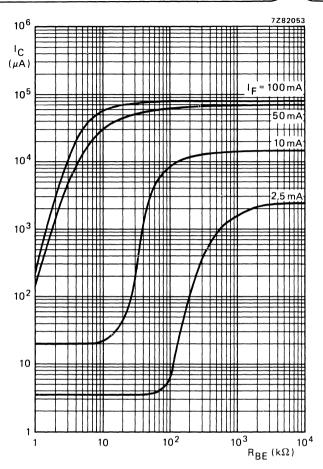


Fig. 15 CNY57AU; $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

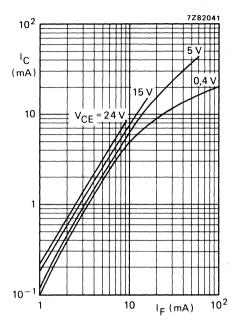


Fig. 16 **CNY57U**; $T_{amb} = 25$ °C; typical values.

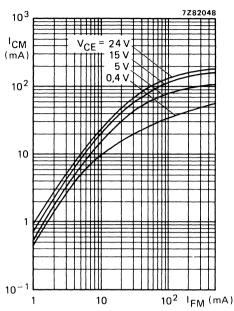


Fig. 17 **CNY57AU**; T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

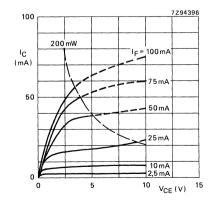


Fig. 18 **CNY57U**; $T_{amb} = 25$ °C; typical values.

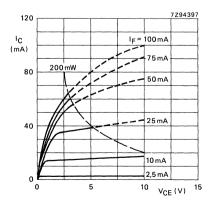


Fig. 19 CNY57AU; T_{amb} = 25 °C; typical values.

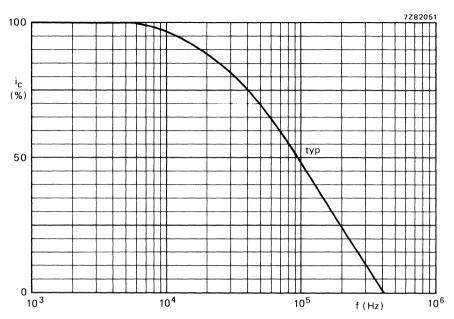
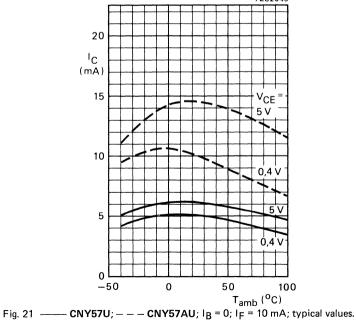


Fig. 20 I_B = 0; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω ; T_{amb} = 25 °C.



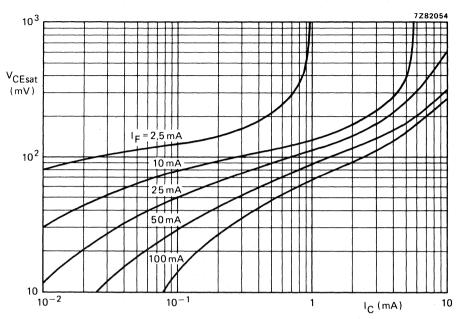


Fig. 22 CNY57U; $I_B = 0$; $T_{amb} = 25$ °C; typical values.

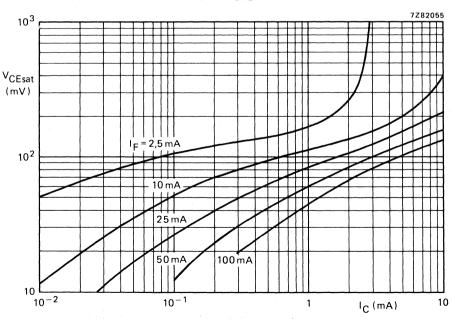
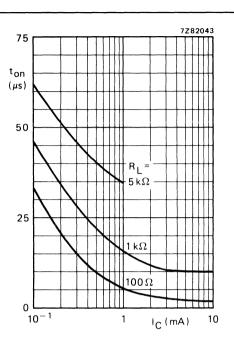


Fig. 23 CNY57AU; $I_B = 0$; $T_{amb} = 25$ °C; typical values.



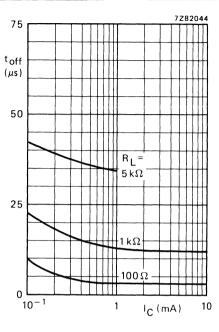
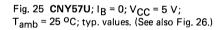
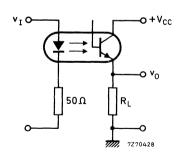


Fig. 24 CNY57U; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typ. values. (See also Fig. 26.)





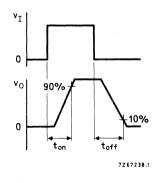
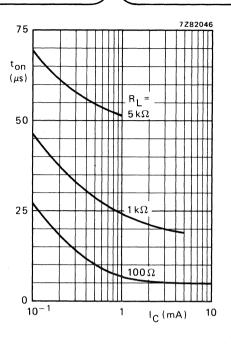


Fig. 26 Switching circuit and waveforms.



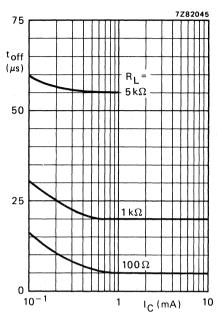
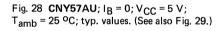
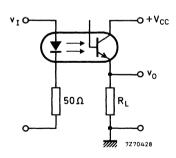


Fig. 27 CNY57AU; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typ. values. (See also Fig. 29.)





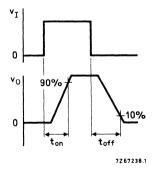


Fig. 29 Switching circuit and waveforms.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor without accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- a high isolation voltage
 CNY62 3,75 kV (r.m.s.) and 5,3 kV (d.c.);
 CNY63 3 kV (r.m.s.) and 4.3 kV (d.c.);
- working voltage 1,5 kV.

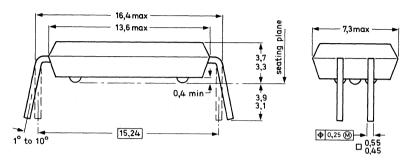
QUICK REFERENCE DATA

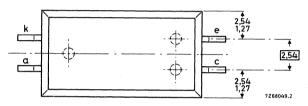
Diode		С	NY62	CNY63	
Continuous reverse voltage	v_R	max.	5	5	٧
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.1$	l _F lerm	max. max.	100 1000	100 1000	
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	150	150	mW
Transistor					
Collector-emitter voltage (open base)	V _{CEO}	max.	50	30	٧
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	200	200	mW
Optocoupler					
Output/input d.c. current transfer ratio (C.T.R.) I _F = 10 mA; V _{CE} = 0,4 V; (I _B = 0)	I _C /I _F	min.	0,25	0,50	
Collector cut-off current (dark) V _{CC} = 10 V; working voltage (d.c.) = 1,5 kV					
diode: $I_F = 0$ (see also Fig. 2)	ICEW	max.	200	200	nΑ
Isolation voltage (d.c.)	v_{IORM}	min.	5,3	4,3	kV

MECHANICAL DATA

Fig. 1 SOT-91B.

Dimensions in mm







max.

5 V

 V_R

- Positional accuracy.
- M Maximum material condition.

RATINGS

Continuous reverse voltage

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current				
d.c.	İF	max.	100	mΑ
(peak value); $t_p = 10 \mu s$; $\delta = 0.1$	IFRM	max.	1000	mA
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	150	mW
Operating junction temperature	T_{j}	max.	125	οС
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	٧
CNY63	V_{CEO}	max.	30	٧
Emitter-collector voltage (open base)	VECO	max.	7	٧
Collector current (d.c.)	1 _C	max.	100	mΑ

			_		
Total power dissipation up to $T_{amb} = 25$ °C		P _{tot}	max.	200 mW	1
Operating junction temperature		T_{j}	max.	125 °C	
Optocoupler					
Storage temperature		T_{stg}	-55	5 to +150 °C	
Lead soldering temperature up to the seating plane; $t_{\mbox{sld}} < 10 \ \mbox{s}$		T _{sld}	max.	260 °C	
THERMAL RESISTANCE					
From junction to ambient in free air diode transistor		R _{th j-a} R _{th j-a}	=	650 K/W 500 K/W	
From junction to ambient, device mounted on a printed-circuit board diode transistor		R _{th j-a} R _{th j-a}	=	600 K/V 400 K/V	
(Talisisto)		''tn j-a		400 K/V	•
CHARACTERISTICS					
T _j = 25 °C unless otherwise specified					
Diode					
Forward voltage I _F = 10 mA		VF	typ.	1,2 V 1,5 V	
Reverse current V _R = 5 V		I _R	<	10 μΑ	
Transistor (diode: $I_F = 0$)					
Collector cut-off current (dark) $V_{CE} = 10 \text{ V}$		ICEO	typ.	5 nA 100 nA	
$V_{CE} = 10 \text{ V}; T_{amb} = 70 ^{\circ}\text{C}$		ICEO	<	10 μΑ	
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$	CNY62 CNY63	V _(BR) Ci	EO	min 50 V min 30 V	
Emitter-collector breakdown voltage I _E = 0,1 mA	CNY62 CNY63	V _(BR) C	ΞO	min 7V min 7V	
Optocoupler (I _B = 0)*					
Output/input d.c. current transfer ratio (C.T $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	CNY62	I _C /I _F	> typ.	0,25 0,50	
	CNY63	I _C /I _F	> typ.	0,5 1,0	
Collector cut-off current (dark) see Fig. 2				,	
$V_{CC} = 10 \text{ V}$; working voltage (d.c.) = 1,5		CEW	<	200 nA	
V_{CC} = 10 V; working voltage (d.c.) = 1,5	κν; 1 _j = 70 °C	ICEM	<	100 μΑ	

^{*} Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY62	CNY63	
I _F = 10 mA; I _C = 2 mA	V _{CEsat}	typ.	0,17 0,40	l .	v v
I _F = 10 mA; I _C = 4 mA	V _{CEsat}	typ.	_	0,17 0,40	
Isolation voltage; t = 1 min	VIORM	min.	5,3	4,3	kV(d.c.)
	VIORM	min.	3,75	3	kV(r.m.s.)
Capacitance between input and output IF = 0; V = 0; f = 1 MHz	C _{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output $\pm V_{10} = 1 \text{ kV}$	r _{IO}	> typ.	10 ¹⁰ 10 ¹²	10 ¹⁰ 10 ¹²	
Switching times (see Fig. 19) $I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$					
Turn-on time	ton	typ.	3	_	μs
Turn-off time	toff	typ.	3	-	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω Turn-on time Turn-off time	t _{on}	typ.	_		μs μs
Turn-off time	toff	typ.	-	ן ס	μs

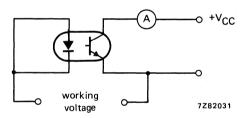
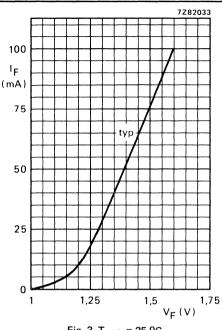
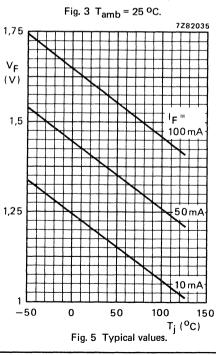
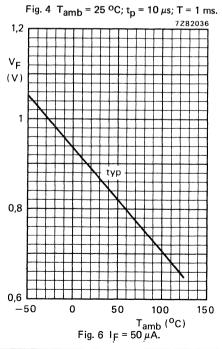


Fig. 2.



1000 | TFM (mA) | 750 | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ | Typ |





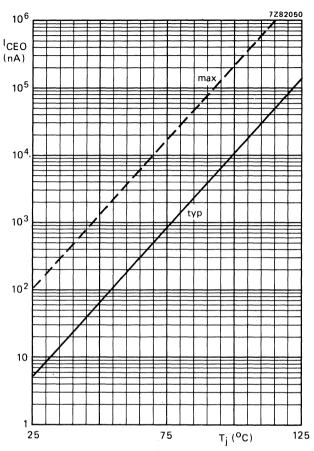
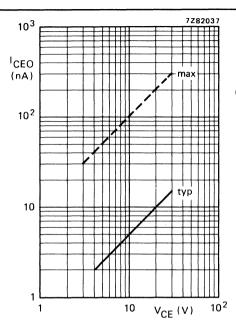


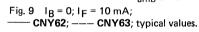
Fig. 7 $I_F = 0$; $V_{CE} = 10 \text{ V}$.

7Z82049



20 | C (mA) | 15 | V_{CE} = | 5 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4 V | O,4

Fig. 8 $I_F = 0$; $T_j = 25$ °C.



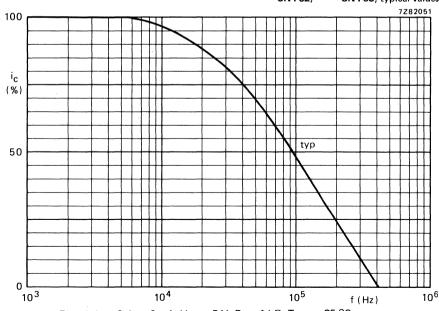


Fig. 10 $I_B = 0$; $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 1 \text{ k}\Omega$; $T_{amb} = 25 \text{ °C}$.

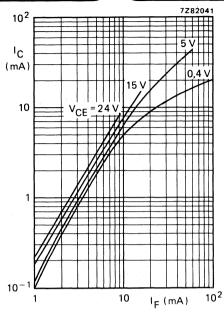


Fig. 11 CNY62; T_{amb} = 25 °C; typical values.

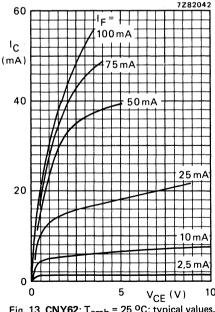


Fig. 13 CNY62; T_{amb} = 25 °C; typical values.

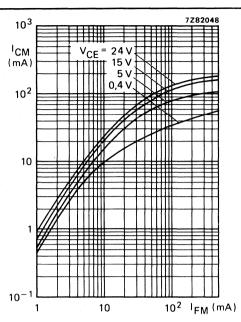
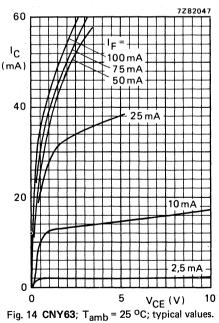


Fig. 12 **CNY63**; T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.



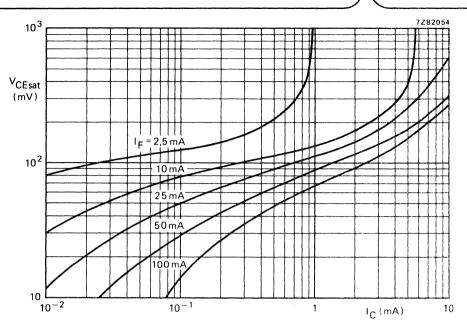


Fig. 15 CNY62; $I_B = 0$; $T_{amb} = 25$ °C; typical values.

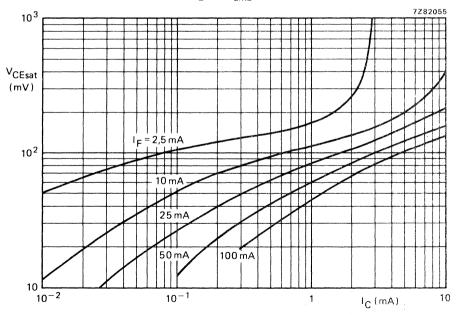


Fig. 16 CNY63; $I_B = 0$; $T_{amb} = 25$ °C; typical values.

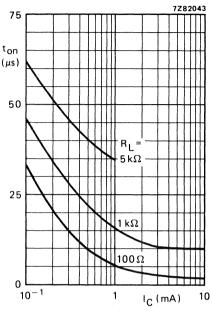


Fig. 17 CNY62; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 19).

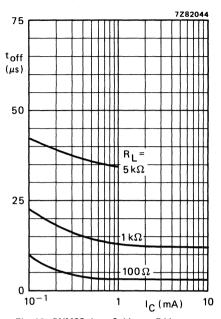
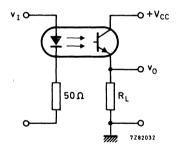


Fig. 18 CNY62; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 19).



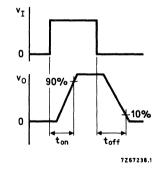


Fig. 19 Switching circuit and waveforms.

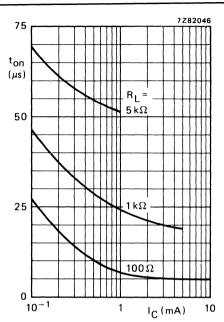


Fig. 20 CNY63; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 22).

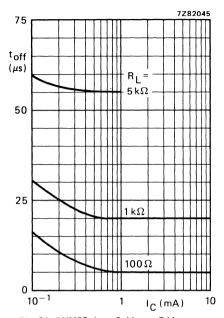
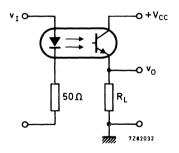


Fig. 21 CNY63; $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25 \, ^{\circ}\text{C}$; typical values. (See also Fig. 22).



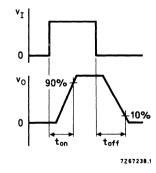


Fig. 22 Switching circuit and waveforms.

OPTOCOUPLERS

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply to the specifications of the main part of the optocoupler market.

This range can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and an N-P-N silicon phototransistor.

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

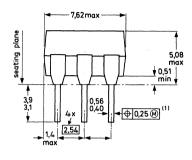
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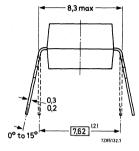
Collector-emitter voltage of phototransistor		V _{CEO}	max.	30 V
Forward current of infrared emitting diode (d.c.)		lF	max.	60 mA
D.C. current transfer ratio at				
$I_F = 10 \text{ mA}; V_{CF} = 10 \text{ V}$	H11A1	IC/IE	min.	0,5
· •	H11A2	IC/IE	min.	0,2
	H11A3	IC/IE	min.	0,2
	H11A4	IC/IF	min.	0,1
Total power dissipation				
up to T _{amb} = 25 °C		P_{tot}	max.	250 mW
Isolation voltage (d.c.)		v_{IORM}	min.	2 kV (r.m.s.)

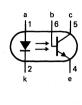
MECHANICAL DATA

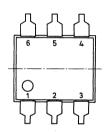
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- (M) Maximum Material Condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

Limiting factors in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	٧ _R	max.	5 V
Forward current			
d.c.	۱۴	max.	60 mA
peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3 A
Total power dissipation			
up to T _{amb} = 25 °C	P _{tot}	max.	100 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	30 V
Collector-base voltage (open emitter)	VCBO	max.	70 V
Emitter-collector voltage (open base)	VECO	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation			
up to T _{amb} = 25 °C	P _{tot}	max.	150 mW

Optocoupler				
Storage temperature	T_{stg}	-55 t	o +150	οС
Operating junction temperature	T _i	-55 t	o +100	oC
Operating temperature	·			
up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260	oC
Total power dissipation	р.		250	\A/
up to T _{amb} = 25 °C	P _{tot}	max.	250	ITIVV
THERMAL RESISTANCE				
From junction to ambient in free air	5		F00	16 (14)
diode transistor	R _{th j-a} R _{th i-a}	max. max.	500 500	
	···tii j-a		-	,
LINEAR DERATING FACTORS				
Above 25 °C diode			1.33	mW/K
transistor				mW/K
ISOLATION RELATED VALUES				
External air gap (clearance)				
input terminals to output terminals	L(IO1)	min.	7,2	mm
External tracking path (creepage distance)				
input terminals to output terminals	L(102) ·	min.	7,0	mm
Tracking resistance (KB-value)		KB-100)/A	
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Diode				
Forward voltage			1 15	
I _F = 10 mA	VF	typ. max.	1,15 1,5	
Reverse current			,	
V _R = 5 V	IR	max.	10	μΑ
Capacitance at f = 1 MHz	_			_
V = 0	Cd	typ.	50	pF
Transistor				
Collector-emitter breakdown voltage				
I _C = 10 mA	V(BR)CEO	min.	30	V
Collector-base breakdown voltage I _C = 0,1 mA	V(BR)CBO	min.	. 70	V
Emitter-collector breakdown voltage	V(BR)CBO		. , ,	•
I _E = 0,1 mA	V _{(BR)ECO}	min.	7	V
Dark current		tvn	າ	nΑ
V _{CE} = 10 V	ICEO	typ. max.	50	

H11A1 H11A2 H11A3 H11A4

Optocoupler

Output/input d.c. current transfer ratio IF = 10 mA; VCF = 10 V 0,5 H11A1 IC/IE min. H11A2, H11A3 IC/IF min. 0,2 H11A4 0.1 IC/IE min. Collector-emitter saturation voltage 0.4 V max. $I_F = 10 \text{ mA}$; $I_C = 0.5 \text{ mA}$ **VCEsat** typ. 0,1 V Output capacitance at f = 1 MHz $V_{CE} = 10 V$ CCF 2 pF typ. 2 kV (r.m.s.) Isolation voltage * VIORM min. 2,82 kV (d.c.) Capacitance between input and output V = 0: f = 1 MHzCio max. 2 pF Insulation resistance between input and output $V_{10} = 500 \text{ V}$ $10^{11} \Omega$ Rio min. Rise time $I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$ tr typ. 3 μs Fall time $I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$ 3 μs typ. tf

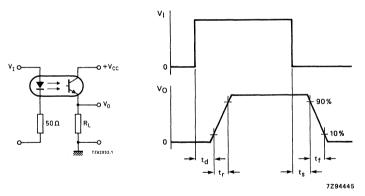


Fig. 2 Measuring circuit and waveforms.

^{*} Every single product is tested by applying an isolation test voltage of 2500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

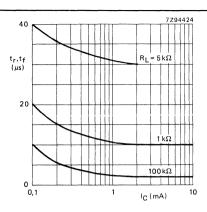


Fig. 3 $V_{CC} = 10 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

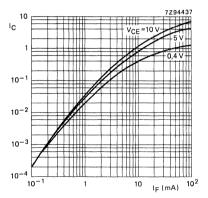


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

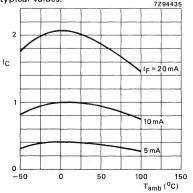


Fig. 7 Normalized at $I_F = 10 \text{ mA}$; $V_{CE} = 10V$; typical values.

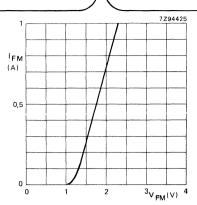


Fig. 4 $T_{amb} = 25$ °C; $t_{on} = 20 \mu s$; $\delta = 0.01$; typical values.

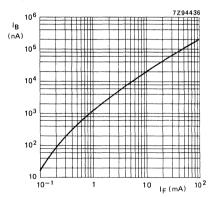


Fig. 6 $V_{CB} = 10 \text{ V}; T_{amb} = 25 \text{ °C};$

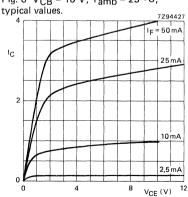


Fig. 8 Normalized at 10 mA; V_{CE} = 10 V; $T_{amb} = 25^{\circ}C$. typical values.

OPTOCOUPLER

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply to the specifications of the main part of the optocoupler market.

It can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and an N-P-N silicon phototransistor.

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C) DIN IEC 65/VDE 0860/8.81

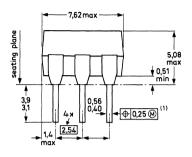
QUICK REFERENCE DATA

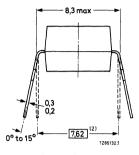
Collector-emitter voltage of phototransistor	VCEO	max.	30 V
Forward current of infrared emitting diode (d.c.)	lF	max.	60 mA
D.C. current transfer ratio at IF = 10 mA; VCE = 10 V	IC/IF	min.	0,2
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	250 mW
Isolation voltage d.c. value	V _{IORM}	min.	4,4 kV

MECHANICAL DATA

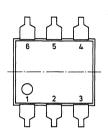
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- M Maximum Material Condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

Limiting factors in accordance with the Absolute Maximum System (IEC 134)

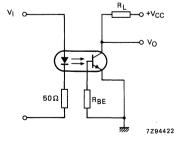
٧R	max.	5	V
IF.	max.	60	mΑ
FRM	max.	3	Α
P_{tot}	max.	200	mW
VCEO	max.	30	٧
VCBO	max.	70	٧
VECO	max.	- 7	٧
IC	max.	50	mΑ
P_{tot}	max.	200	mW
	Ptot VCEO VCBO VECO IC	IF max. IFRM max. Ptot max. VCEO max. VCBO max. VECO max. IC max.	IF max. 60 IFRM max. 3 Ptot max. 200 VCEO max. 30 VCBO max. 70 VECO max. 7 IC max. 50

Optocoupler MCT2

	Optocoupler				
	Storage temperature	T_{stq}	–55 to 1	-150	оС
	Operating junction temperature	T _i	–55 to ⁴	125	oC
	Soldering temperature up to the seating plane; $t_{sld} < 10 \text{ s}$	T _{sld}	max.	260	оС
	Total power dissipation up to $T_{amb} = 25 {}^{\circ}\text{C}$	P _{tot}	max.	250	mW
	THERMAL RESISTANCE				
	From junction to ambient in free air diode transistor	R _{th j-a} R _{th j-a}	max.		K/W K/W
	LINEAR REPAINS FACTORS	, .			
	LINEAR DERATING FACTORS Above 25 °C				
	diode transistor				mW/K mW/K
	optocoupler			3,3	mW/K
	ISOLATION RELATED VALUES				
	External air gap (clearance)				
	input terminals to output terminals	L(IO1)	min.	7,2	mm
	External tracking path (creepage distance) input terminals to output terminals	L(102)	min.	7,0	mm
	Tracking resistance (KB-value)		KB-100/A	4	
	CHARACTERISTICS				
	$T_j = 25$ °C unless otherwise specified				
	Diode				
	Forward voltage				
	IF = 20 mA	VF	typ. max.	1,2 1,5	
	Reverse current	1-			`
	$V_R = 5 V$ Capacitance at f = 1 MHz	¹ R	max.	10	μΑ
	V = 0;	C_d	typ.	50	pF
	Transistor				
	Collector-emitter breakdown voltage				
	I _C = 1 mA	V(BR)CEO	min.	30	V
	Collector-base breakdown voltage IC = 0,01 mA	V(BR)CBO	min.	70	V
	Emitter-collector breakdown voltage				
	$I_E = 0.1 \text{ mA}$	V(BR)ECO	min.	7	V
	Dark current	1	typ.	2	nA
	V _{CE} = 10 V	CEO	max.		nA
	V _{CB} = 10 V	СВО	max.	20	nA
	D.C. current gain $I_C = 100 \mu A$; $V_{CE} = 5 V$	hFE	typ.	300	
_	· · · · · · · · · · · · · · · · · ·				

Optocoupler

Output/input d.c. current transfer ratio				
I _F = 10 mA; V _{CE} = 10 V	IC/IF	typ. min.	0,6 0,2	
Collector-emitter saturation voltage $I_F = 16 \text{ mA}$; $I_C = 2 \text{ mA}$	V _{CEsat}	max. typ.	0,4 0,15	
Emitter-base capacitance VBE = 0	C _{be}	typ.	8	pF
Collector-base capacitance at f = 1 MHz V _{CB} = 10 V	C _{bc}	typ.	4,5	pF
Collector-emitter capacitance VCE = 0	C _{ce}	typ.	8	pF
Isolation voltage*	VIORM	min.		kV(d.c.) kV(r.m.s.)
Capacitance between input and output V = 0; f = 1 MHz	C _{io}	typ.	0,5	pF
Insulation resistance between input and output $V_{10} = \pm 500 \text{ V}$	RIO	min. typ.	10 ^{1 1} 10 ^{1 2}	
Turn-on time (saturated) see Fig. 2 (TTL def.) $I_F = 15 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 2 \text{ k}\Omega$				
$R_{BE} = \infty$ $R_{E} = 20 \text{ mA; } V_{CC} = 5 \text{ V; } R_{L} = 2 \text{ k}\Omega$	ton	typ.		μs
$R_{BE} = 100 \text{ k}\Omega$ Turn-off time (saturated) see Fig. 2 (TTL def.)	^t on	typ.	5	μs
$I_F = 15 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 2 \text{ k}Ω$ $R_{BE} = \infty$	^t off	typ.	30	μs
$I_F = 20$ mA; $V_{CC} = 5$ V; $R_L = 2$ kΩ $R_{BE} = 100$ kΩ	toff	typ.	10	μs
Bandwidth $I_C = 2 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $R_L = 100 \text{ k}\Omega$	BW	typ.	300	kHz



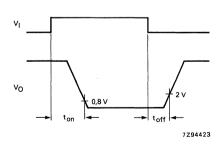


Fig. 2 Measuring circuit and waveforms.

^{*} Every single product is tested by applying an isolation test voltage of 3750 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

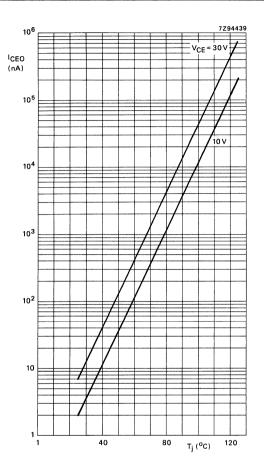


Fig. 3. Typical values.

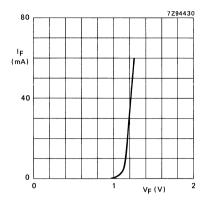


Fig. 4 T_{amb} = 25 °C; typical values.

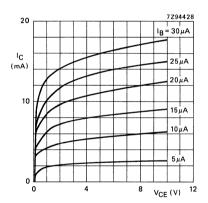


Fig. 5 T_{amb} = 25 °C; typical values.

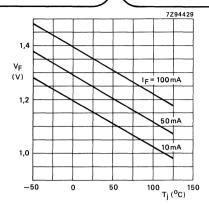


Fig. 6 Typical values.

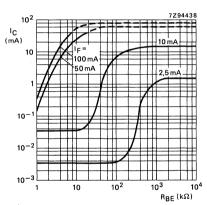


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

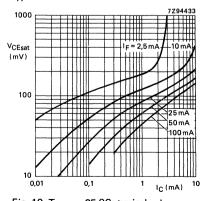


Fig. 10 $T_{amb} = 25$ °C; typical values.

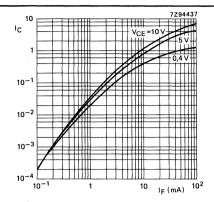


Fig. 7 Normalized to $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

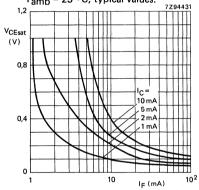


Fig. 9 T_{amb} = 25 °C; typical values.

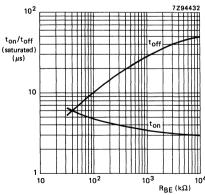


Fig. 11 IF = 20 mA; $R_L = 2 k\Omega$; $T_{amb} = 25 \, ^{o}C$; typical values.

OPTOCOUPLER

Optocoupler in a DIL plastic envelope. The MCT26 comprises an infrared GaAs diode and a N-P-N silicon phototransistor.

UL - Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.83

Complied for reinforced isolation at 250 VAC with:

DIN 57 804/VDE 0804/1.83 (isolation group C)

DIN IEC 65/VDE 0860/8.81

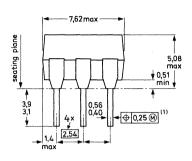
QUICK REFERENCE DATA

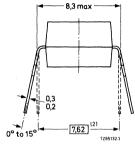
Collector-emitter voltage of phototransistor	V _{CEO}	max.	30 V
Forward current of infrared emitting diode (d.c.)	1F	max.	60 mA
D.C. current transfer ratio at $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$	IC/IF	min.	0,06
Total power dissipation up to T _{amb} = 25 ^o C	P _{tot}	max.	250 mW
Isolation voltage d.c. value	VIORM	min.	4,4 kV

MECHANICAL DATA

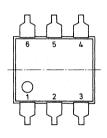
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- M Maximum Material Condition.
- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

Limiting factors in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	٧R	max.	5 V
Forward current d.c.	ļF	max.	60 mA
peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3 A
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	30 V
Collector-base voltage (open emitter)	V _{CBO}	max.	30 V
Emitter-collector voltage (open base)	VECO	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW

Optocoupler			
Storage temperature	T_{stg}		o +150 °C
Operating junction temperature	Тj	–55 t	o + 125 °C
Soldering temperature up to the seating plane; $t_{ m sld}$ $<$ 10 s	T _{sld}	max.	260 °C
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	250 mW
THERMAL RESISTANCE			
From junction to ambient in free air			
diode	R _{th j-a}	max.	500 K/W
transistor	R _{th j-a}	max.	500 K/W
LINEAR DERATING FACTORS			
Above 25 °C			
diode			2,6 mW/K
transistor			2,6 mW/K
optocoupler			3,3 mW/K
ISOLATION RELATED VALUES			
External air gap (clearance)			
input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage distance)	1 (100)		7.0
input terminals to output terminals	L(102)	min.	7,0 mm
Tracking resistance (KB-value)		KB-100	J/A
CHARACTERISTICS			
T _j = 25 °C unless otherwise specified			
Diode			
Forward voltage			12.
I _F = 20 mA	٧F	typ. max.	1,2 V 1,5 V
Reverse current		max.	1,5 ¥
V _R = 5 V	1 _R	max.	10 μΑ
Capacitance at f = 1 MHz	'n	maxi	,,,,
V = 0	C_{d}	typ.	50 pF
- ···	ű.		
Transistor			
Collector-emitter breakdown voltage	Vinniana	min	30 V
	V(BR)CEO	min.	30 V
Collector-base breakdown voltage IC = 0,01 mA	V(BR)CBO	min.	30 V
Emitter-collector breakdown voltage	v(BK)CBO		30 V
IF = 0,1 mA	V(BR)ECO	min.	7 V
Dark current	· (BII)ECO		
VCE = 5 V	ICEO	typ.	2 nA 100 nA
	ІСВО	max. max.	100 nA 100 nA
Vcr = 5 V	טפטי	11147	.00
V _{CB} = 5 V D.C. current gain			

Optocoupler

Output/input d.c. current transfer ratio			
$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	IC/IF	min.	0,06
Collector-emitter saturation voltage $I_F = 20 \text{ mA}$; $I_C = 0.25 \text{ mA}$ $I_F = 60 \text{ mA}$; $I_C = 1.6 \text{ mA}$	V _{CEsat}	max. typ. max. typ.	0,3 V 0,1 V 0,5 V 0,2 V
Collector-emitter capacitance			
V _{CE} = 0	C _{ce}	typ.	8 pF
Isolation voltage *	VIORM	min.	4,4 kV(d.c.) 3,12 kV(r.m.s.)
Capacitance between input and output V = 0; f = 1 MHz	C _{io}	typ.	0,5 pF
Insulation resistance between			
input and output V _{IO} = 500 V	R _{IO}	min. typ.	$\begin{array}{ccc} 10^{11} & \Omega \\ 10^{12} & \Omega \end{array}$
Rise time (see Fig. 2) I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t _r	typ.	3 μs
Fall time (see Fig. 2) $I_C = 2$ mA; $V_{CC} = 10$ V; $R_L = 100$ Ω	tf	typ.	3 μs
Bandwidth $I_C = 2 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $R_L = 100 \Omega$	BW	typ.	300 kHz

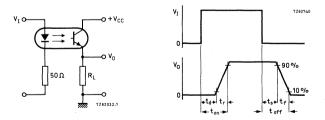
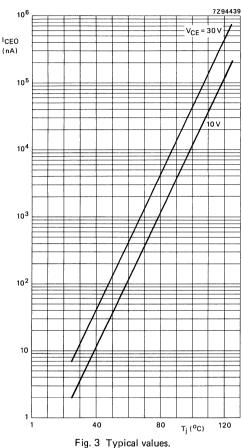


Fig. 2 Measuring circuit and waveforms.

^{*} Every single product is tested by applying an isolation test voltage of 3750 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.



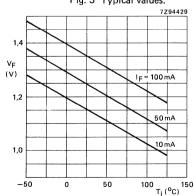


Fig. 6 Typical values.

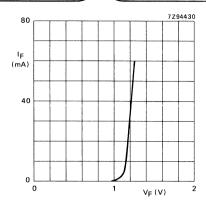


Fig. 4 T_{amb} = 25 °C; typical values.

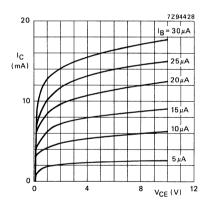


Fig. 5 T_{amb} = 25 °C; typical values.

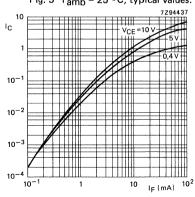


Fig. 7 Normalized to IF = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

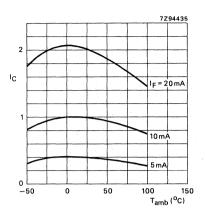


Fig. 8 Normalized to I $_{F}$ = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

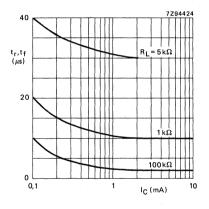


Fig. 9 T_{amb} = 25 °C; typical values.

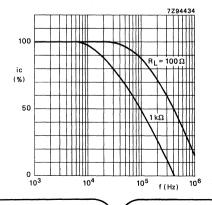


Fig. 10 $I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $T_{amb} = 25 \text{ °C}$; typical values.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAlAs diode and a silicon n-p-n phototransistor with accessible base in a SOT-90B envelope. Designed for low input current and long life operation.

The application of an IR emitting device, based on a special GaAlAs (intrinsic) process, results in perfect linearity at low input currents and a very low degradation during the device's operating life.

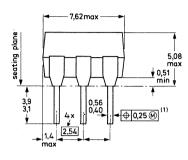
The PO40/44A is selected according to British Telecom specifications for telephony and can serve for each individual spec PO40A, PO41A, PO42A, PO43A, PO44A and is BT approved.

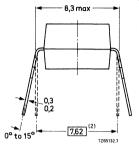
QUICK REFERENCE DATA

Diode			
Forward current (d.c.)	l F	max.	100 mA
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	30 V
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.)			
$I_F = 0.5 \text{ mA}; V_{CE} = 5 \text{ V}$	IC/IF	min.	0,1
$I_F = 1.0 \text{ mA}; V_{CE} = 0.4 \text{ V}$	IC/IF	min.	0,25
$I_F = 10 \text{ mA}$; $V_{CE} = 0.5 \text{ V}$	IC/IF	min.	0,6
Leakage current under working voltage 1,5 kV d.c. value			
$V_{CC} = 10 V$	ICEW	max.	200 nA
Isolation voltage			
d.c. value	VIORM	min.	3,5 kV

MECHANICAL DATA

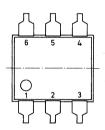
Fig. 1 SOT-90B.







Dimensions in mm



- Positional accuracy.
- (M) Maximum Material Condition.

 P_{tot}

max.

200 mW

- Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	VR	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	lf lfrm	max.	100 mA 2,5 A
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V _{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	70 V
Emitter-collector voltage (open base)	VECO	max.	5 V
Collector current	IC	max.	100 mA
Total power dissipation			

up to $T_{amb} = 25$ oC

Optocoupler				
Storage temperature	T_{stq}	-55 t	-55 to +150 °C	
Operating ambient temperature	T _{amb}	-55 t	o +100	oC
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	250	mW
Lead soldering temperature up to the seating plane; $t_{\mbox{sld}} <$ 10 s	T _{sld}	max.	260	oC
THERMAL RESISTANCE				
From junction to ambient in free air diode transistor	R _{th j-a} R _{th j-a}	max. max.		K/W K/W
From junction to ambient, device mounted on a printed circuit board diode transistor	R _{th j-a} R _{th j-a}	max. max.		K/W K/W
ISOLATION RELATED VALUES				
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2	mm
External tracking path (creepage distance) input terminals to output terminals	L ₍₁₀₂₎	min.	7,0	mm
Tracking resistance (KB-value)		KB-100/A		
CHARACTERISTICS				
$T_j = 25$ °C unless otherwise specified				
Diode				
Forward voltage I _F = 10 mA	٧ _F	typ. max.	1,45 1.6	V V *
I _F = 0,1 mA; T _{amb} = 70 °C	· V _F	min.	0,45	
Reverse current V _R = 5 V	IR	max.	10	μΑ
Transistor				
Collector-emitter breakdown voltage open base; I _C = 1 mA	V(BR)CEO	min.	30	V
Collector-base breakdown voltage open emitter; I _C = 0,1 mA	V _(BR) CBO	min.	70	V
Emitter-collector breakdown voltage open base; I _E = 0,1 mA	V(BR)ECO	min.	5	V
Collector cut-off current (dark) VCE = 28 V	ICEO	typ. max.	2 200	nA nA

^{*} Internal specification.

Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 0,5 V	I _C /I _F	min. max.	0,6 1,5
IF = 1 mA; V _{CE} = 0,4 V IF = 0,5 mA; V _{CE} = 5 V IF = 3 mA; V _{CE} = 1 V IF = 5 mA; V _{CE} = 5 V IF = 10 mA; V _{CE} = 10 V IF = 20 mA; V _{CE} = 0,5 V	C/ F C/ F C/ F C/ F C/ F	min. min. min. min. min. min.	0,25 0,1 0,3 0,3 0,25 0,25
Collector current I _F = 0,1 mA; V _{CE} = 5 V	ICE	max.	100 μΑ
DC current gain $I_C = 0.4$ mA; $V_{CE} = 1$ V	hFE	min.	200
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 1 \text{ mA}$	V _{CEsat}	max.	0,5 V
Output capacitance V _{CB} = 10 V; f = 1 MHz	C _{bc}	typ.	4,5 pF
Collector cut-off current (dark) at working voltage $V_W = 1,5 kV$; (d.c. value) see notes 1 and 2			
V _{CC} = 10 V; V _{CC} = 10 V; T _i = 70 °C	lCEW	max. max.	200 nA 100 μA
Isolation voltage (d.c. value)	CEW		100 μ/ (
see note 3	VIORM	min.	3,5 kV
Capacitance between input and output V = 0; f = 1 MHz	C _{io}	typ.	0,6 pF
Insulation resistance between input and output $\pm V_{10} = 1 \text{ kV}$	R _{IO}	min. typ.	$10^{10} \Omega$ $10^{12} \Omega$
Switching times (see figures 3 and 4) IC = 2 mA; V_{CC} = 5 V; R_L = 100 Ω Turn-on time	t	may	7 μs
Turn off time	^t on	max.	, μ5

toff

7 μs 7 μs

max.

Turn-off time

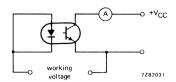


Fig. 2.

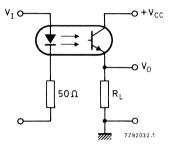


Fig. 3 Switching circuit.

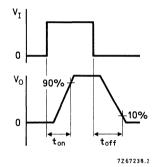


Fig. 4 Waveforms.

Notes.

- 1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the emitter and the two shorted diode leads (see Fig. 2).
- 2. As quality assurance (on a sample basis), these parameters are covered by a 1000 hour reliability test.
- 3. Tested on sample basis. The input diode leads are shorted together an all the transistor leads shorted together, then a test voltage of 4,4 kV (d.c.) is applied for 1 min.

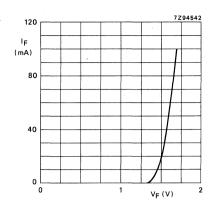


Fig. 5 $T_{amb} = 25$ °C; typical values.

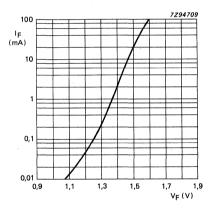


Fig. 7 T_{amb} = 25 °C; typical values.

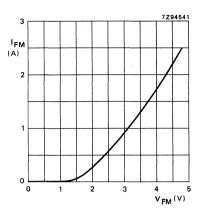


Fig. 6 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms; typical values.

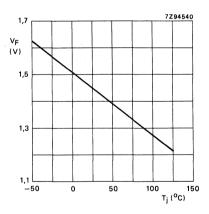


Fig. 8 IF = 10 mA; typical values.

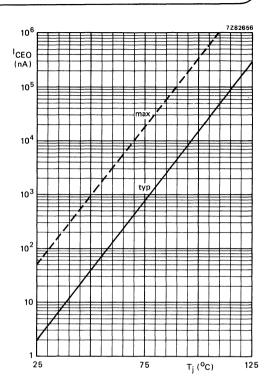
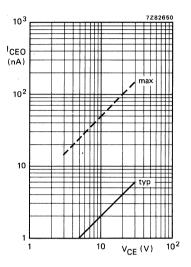


Fig. 9 $I_F = 0$; $V_{CE} = 10 V$; typical values.



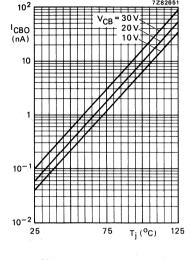


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

Fig. 11 Typical values.

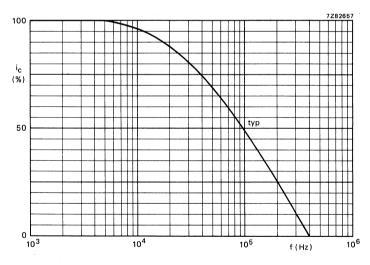


Fig. 12 I $_B$ = 0; I $_C$ = 2 mA; V $_{CC}$ = 5 V; R $_L$ = 1 k Ω ; T $_{amb}$ = 25 °C.

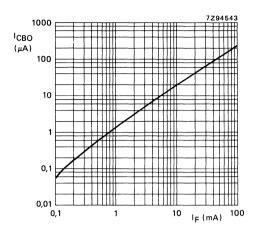


Fig. 13 $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^{o}\text{C}$; typical values.

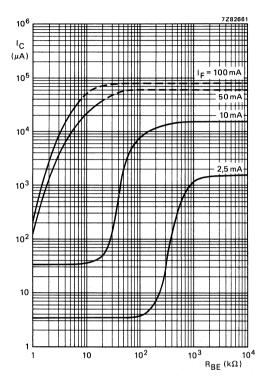


Fig. 14 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^{o}\text{C}$; typical values.

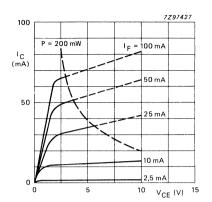


Fig. 15 T_{amb} = 25 °C; typical values.

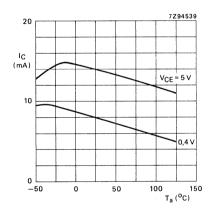


Fig. 17 $I_F = 10 \text{ mA}$; typical values.

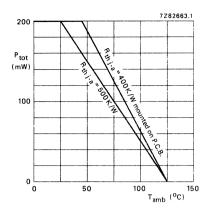


Fig. 16

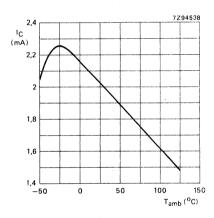


Fig. 18 $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

Fig. 19. $I_B = 0$; $T_{amb} = 25$ °C; typical values.

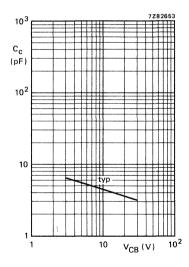


Fig. 20. f = 1 MHz; $T_{amb} = 25 \text{ °C}$.

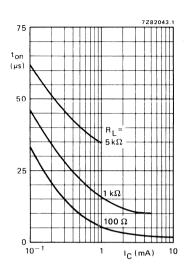


Fig. 21. I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 23).

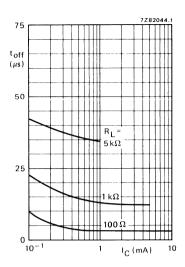
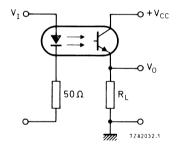


Fig. 22. I $_B$ = 0; V $_{CC}$ = 5 V; T $_{amb}$ = 25 °C; typical values. (See also Fig. 23).



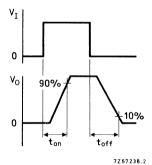


Fig. 23. Switching circuit and waveforms.



OPTOCOUPLERS

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply to the specifications of the main part of the optocoupler market.

This range can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and an N-P-N silicon phototransistor.

UL - Covered under UL component recognition FILE E90700

VDE - Approved according to VDE 0883/6.83

QUICK REFERENCE DATA

Collector-emitter voltage of phototransistor*			V _{CEO}	max.	30 V
Forward current of infrared emitting diode (d.c.)*			IF	max.	80 mA
D.C. current transfer ratio at $I_F = 10$ mA; $V_{CE} = 10$ V*	4N25 to 4N27	4N26 4N28	IC/IF	min. min.	0,2 0,1
Total power dissipation up to T _{amb} = 25 °C Isolation voltage (see note 1)			P _{tot} V _{IORM}	max. min.	250 mW 2,0 kV(r.m.s.)

MECHANICAL DATA

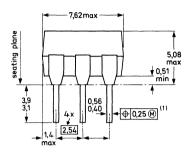
SOT-90B (see Fig. 1).

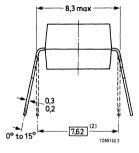
^{*} Indicates JEDEC registered data.

MECHANICAL DATA

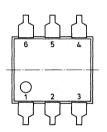
Fig. 1 SOT-90B.

Dimensions in mm









- Positional accuracy.
- Maximum Material Condition.
- Centre-lines of all leads are within \pm 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0,25 mm.
- (2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

Limiting factors in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage*	V _R	max.	5 V
Forward current*			
d.c. peak value; $t_{OR} = 300 \mu s$; $\delta = 0.02$	l _F IFRM	max. max.	80 mA 3 A
Total power dissipation up to T _{amb} = 25 °C *	P _{tot}	max.	150 mW

Transistor

Collector-emitter voltage (open base)*	VCEO	max.	30 V
Collector-base voltage (open emitter)*	VCBO	max.	70 V
Emitter-collector voltage (open base)*	VECO	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Total power dissipation			
up to T _{amb} = 25 °C *	P_{tot}	max.	150 mW

* Indicates JEDEC registered data.

Optocouplers

4N25 4N25A 4N26 4N27 4N28

Optocoupler					
Storage temperature*	T_{stq}	-55 to -	⊦150	oC	
Operating junction temperature*	Ti	–55 to -	⊦100	oC	
Soldering temperature up to the seating plane; $t_{\mbox{sld}} < 10 \mbox{ s}$	T _{sld}	max.	260	оС	
Total power dissipation up to $T_{amb} = 25 ^{\circ}\text{C}$	P _{tot}	max.	250	mW	-
THERMAL RESISTANCE					
From junction to ambient in free air diode transistor	R _{th j-a} R _{th j-a}	max. max.		K/W K/W	
LINEAR DERATING FACTORS					
Above 25 °C diode* transistor* optocoupler*			2	mW/K mW/K mW/K	
ISOLATION RELATED VALUES					
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2	mm	
External tracking path (creepage distance) input terminals to output terminals	L(102)	min.	7,0	mm	
Tracking resistance (KB-value)		KB-100/A	4		
CHARACTERISTICS					
$T_j = 25$ °C unless otherwise specified					
Diode					
Forward voltage* IF = 10 mA	VF	typ. max.	1,15 1,5		
Reverse current* VR = 5 V	I _R	max.	100	μΑ	
Capacitance at f = 1 MHz V = 0	C _d	typ.	50	pF	
Transistor					
Collector-emitter breakdown voltage*	V(BR)CEO	min.	30	V	
Collector-base breakdown voltage* $I_C = 0.1 \text{ mA}$	V _(BR) CBO	min.	70	V	
Emitter-collector breakdown voltage* IE = 0,1 mA	V(BR)ECO	min.	7	V	

^{*} Indicates JEDEC registered data.

4N25 4N25A 4N26 4N27 4N28

Dark current *				
VCE = 10 V	4N25 to 4N27	ICEO	typ.	2 nA
		ICEO	max. max.	50 nA 100 nA
V _{CB} = 10 V	4N28	CBO	max.	20 nA
Optocoupler				
Output/input d.c. current transfer ratio*				
$I_F = 10 \text{ mA; } V_{CE} = 10 \text{ V}$	4N25 to 4N26 4N27 4N28	IC/IF IC/IF	min. min.	0,2 0,1
Collector-emitter saturation voltage*				OFW
$I_F = 50 \text{ mA}; I_C = 2 \text{ mA}$		VCEsat	max. typ.	0,5 V 0,1 V
Isolation voltage			-,,-	·
(see notes 1 and 2)		VIORM	min.	2,0 kV(r.m.s.) 2,8 kV(d.c.)
Canaditanes between input and output				2,6 KV (U.C.)
Capacitance between input and output V _{IO} = 0; f = 1 MHz		Cio	typ.	0,6 pF
Insulation resistance between		10		
input and output				
V _{IO} = 500 V		RIO	typ.	$10^{12} \Omega$
Bandwidth				
$-I_C = 2 \text{ mA; } V_{CE} = 10 \text{ V}$ $R_1 = 100 \Omega$		Bw	typ.	300 kHz
Switching times (unsaturated) see Fig. 2		DVV	typ.	000 KHZ
Rise time				
$I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$		tr	typ.	3 μs
Fall time				
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		tf	typ.	3 μs
Switching times (saturated) see Fig. 3				
Turn-on time (TTL def.)				
IF = 15 mA; V_{CC} = 5 V; R_L = 2 k Ω				e
$R_{BE} = \infty$ $I_F = 20 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 2 \text{ k}\Omega$		^t on	typ.	5 μs
$R_{BE} = 100 \text{ k}\Omega$		ton	typ.	5 μs
Turn-off time (TTL def.)				
$I_F = 15 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2 \text{ k}\Omega$				
R _{BE} = ∞ I _F = 20 mA; V _{CC} = 5 V; R _I = 2 k Ω		toff	typ.	30 μs
$R_{BE} = 100 \text{ k}\Omega$		toff	typ.	10 μs
		311		•

^{*} Indicates JEDEC registered data.

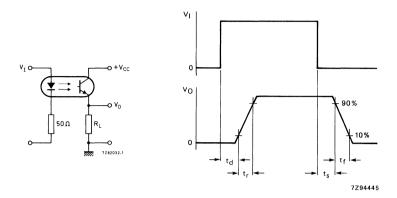


Fig. 2 Measuring circuit and waveforms.

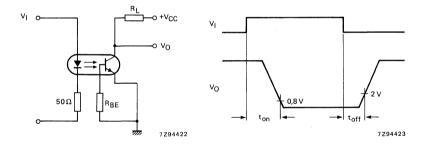


Fig. 3 Measuring circuit and waveforms.

Note 1:

Satisfies JEDEC registered isolation voltage ratings (min. V₁₀):

4N25	2,5 kV (peak)
4N25-A	1,775 kV (r.m.s.)
4N26	1,5 kV (peak)
4N27	1,5 kV (peak)
4N28	0,5 kV (peak)

Note 2:

Every single product is tested by applying an isolation test voltage of 2500 V (r.m.s.) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

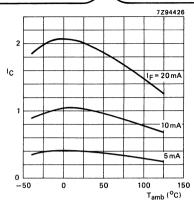


Fig. 4 Normalized at IF = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

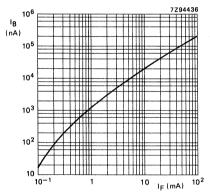


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

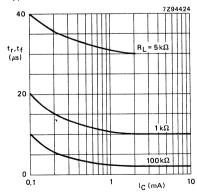


Fig. 8 Normalized at IF = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

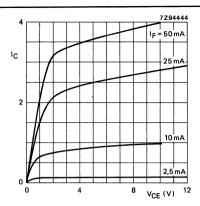


Fig. 5 Normalized at $I_C = 1$ mA; $I_F = 10$ mA; $V_{CE} = 10$ V; typical values.

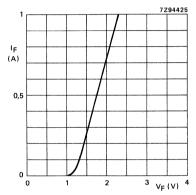


Fig. 7 T_{amb} = 25 °C; t_{on} = 20 μ s; δ = 0,01; typical values.

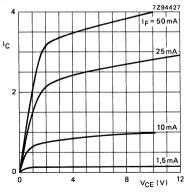


Fig. 9 T_{amb} = 25 °C; typical values.

SECTION B1

Special optocouplers (opto high-tech line)



OPTOCOUPLERS

Optocouplers in a hermetically sealed metal envelope. They have high reliability and can be used under severe conditions such as in military or industrial applications. The CNX44 and CNX46 differ only in the pinning connections and both types have an unconnected base.

An outstanding characteristic is the high common-mode rejection ratio.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	v_R	max.	5 V
Forward current			
d.c.	lF	max.	100 mA
peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3 A
Total power dissipation up to Tamb = 75 °C			
mounted on a p.c.b.	P _{tot}	max.	150 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	50 V
Total power dissipation up to T _{amb} = 75 °C			
mounted on a p.c.b.	P _{tot}	max.	150 mW
Optocoupler			
Output/input d.c. current transfer ratio			
$I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	IC/IF	min.	0,3
Collector cut-off current (dark)			
V _{CE} = 15 V; working voltage (d.c.) = 1,0 kV	ICEW	max.	200 nA
Isolation voltage (d.c.)	VIORM	min.	1,0 kV
Common-mode rejection ratio			
$I_{C} = 2 \text{ mA}$; $f = 10 \text{ kHz}$	CMRR	typ.	85 dB

MECHANICAL DATA

SOT-104C (see Fig. 1).

MECHANICAL DATA

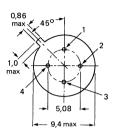
Fig. 1 SOT-104C.

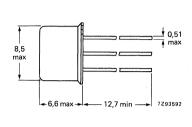
Dimensions in mm

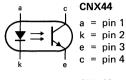
Lead reference

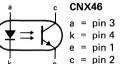
330 K/W

max.









RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V _R	max.	5	٧
Forward current				
d.c.	۱ _F	max.	100	mΑ
peak value; $t_{on} = 10 \mu s$; $\delta = 0.01$	IFRM	max.	3	Α
Total power dissipation up to T _{amb} = 75 °C	P _{tot}	max.	150	mW
Transistor				
Collector-emitter voltage (open base)	V _{CEO}	max.	50	٧
Emitter-collector voltage	VECO	max.	7	٧
Collector current (d.c.)	I _C	max.	100	mΑ
Total power dissipation up to T _{amb} = 75 °C	P_{tot}	max.	150	mW
Optocoupler				
Storage temperature	T_{stq}	65 t	o +150	oC
Operating ambient temperature	T _{amb}	-55 t	o +125	oC
Total power dissipation of diode and				
transistor up to T _{amb} = 75 °C	P _{tot}	max.	300	mW
THERMAL RESISTANCE				
From junction to ambient				
diode	R _{th i-a}	max.	330	K/W
	_ ′			

Rth j-a

transistor

CHARACTERISTICS

T_i = 25 °C unless otherwise specified

Diode

Diode			
Forward voltage I _F = 10 mA	VF	typ. max.	1,15 V 1,30 V
$I_F = 2 \text{ mA}$; $T_{amb} = 0 \text{ to } 70 ^{\circ}\text{C}$	٧ _F	max.	1,20 V
Reverse current V _R = 5 V	I _R	typ. max.	1 μA 100 μA
Transistor			
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$	V _(BR) CEO	min.	50 V
Emitter-collector breakdown voltage I _E = 0,1 mA	V _{(BR)ECO}	min.	7 V
Collector cut-off current (dark); diode F = 0 VCE = 20 V	CEO	typ. max.	5 nA 100 nA
V _{CE} = 20 V; T _{amb} = 70 °C	ICEO	max.	10 μΑ
D.C. current gain $I_C = 10 \text{ mA}$; $V_{CE} = 5 \text{ V}$	hFE	typ.	600
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) IF = 10 mA; VCE = 0,4 V	IC/IF	min. typ.	0,3 0,6
I _F = 10 mA; V _{CE} = 5 V	IC/IF	typ.	1,0
Switching times (see Figs 4 and 5) $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$	^t on ^t off	typ. typ.	5 μs 5 μs
Collector cut-off current (dark) at working voltage 1 kV (d.c. value); $V_{CC} = 15 \text{ V}; T_j = 25 \text{ °C} \text{ (see Fig. 3)}$ $V_{CC} = 15 \text{ V}; T_j = 70 \text{ °C} \text{ (see Fig. 3)}$	ICEW	max. max.	200 nA* 50 μA*
Isolation voltage (d.c. value) between shorted input and shorted output terminals	VIORM	min.	1,0 kV
Capacitance between input and output V = 0; f = 1 MHz	C _{IO}	typ.	1 pF
Insulation resistance between input and output $V_{1O} = 500 \text{ V}$	R _{IO}	min. typ.	$\begin{array}{cccc} 10^{11} & \Omega \\ 10^{12} & \Omega \end{array}$
Common-mode rejection ratio (see Fig. 2) $I_C = 2 \text{ mA}$; f = 10 kHz	CMRR	typ.	85 dB

^{*} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

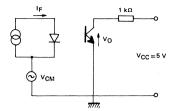


Fig. 2.

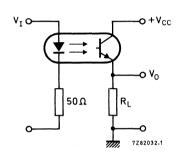
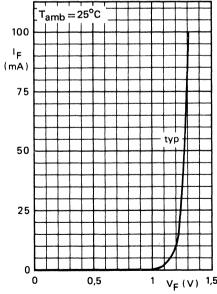


Fig. 4.



1 V_F(V) 1,5

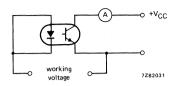


Fig. 3.

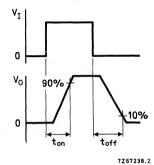


Fig. 5.

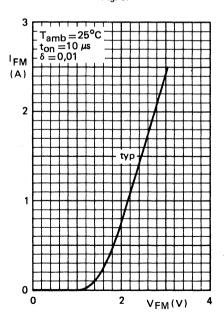
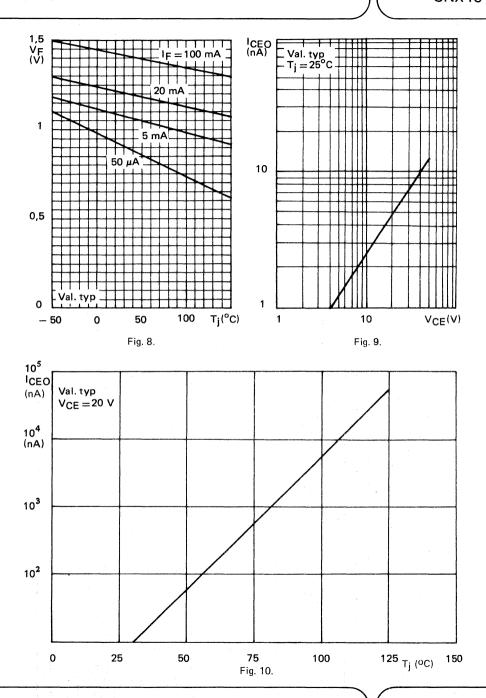


Fig. 7.

Fig. 6.



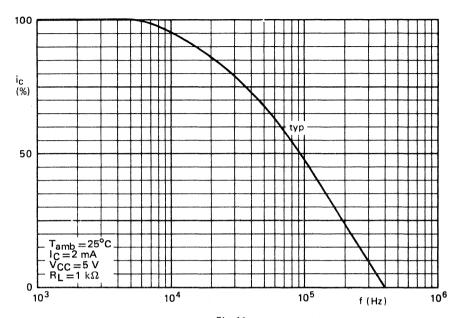


Fig. 11.

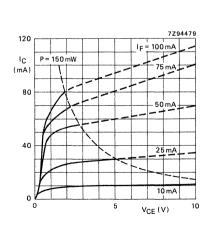


Fig. 12 T_{amb} = 25 °C; typical values.

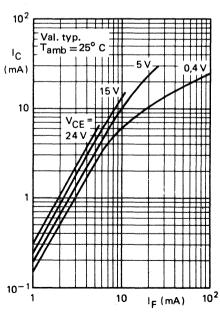


Fig. 13.

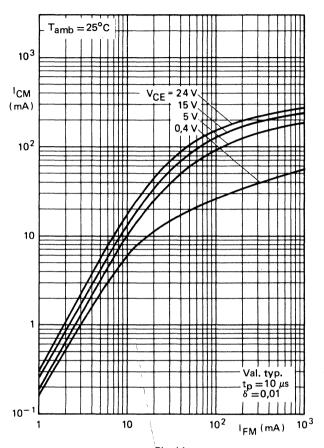


Fig. 14.

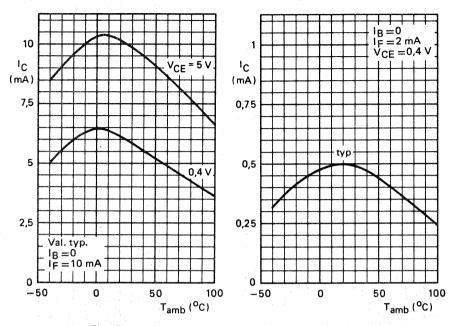
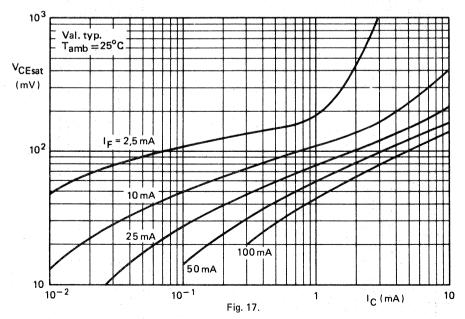
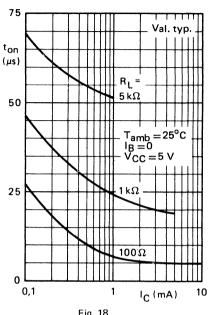


Fig. 15.

Fig. 16.





75 toff (µs) 5kΩ 50 T_{amb} = 25°C I_B = 0 V_{CC} = 5 V 25 1kΩ 100Ω 0 0,1 10 I_C (mA)

Fig. 18.

Fig. 19.

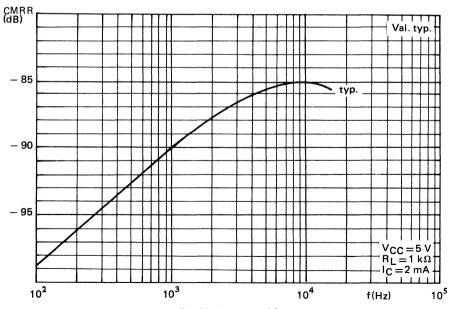


Fig. 20 $T_{amb} = 25$ °C.

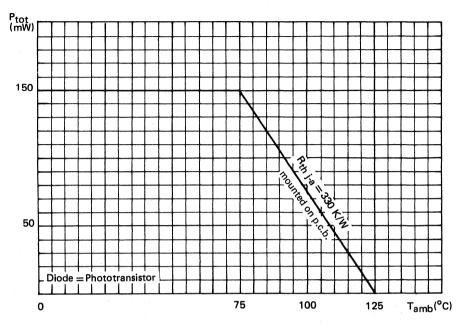


Fig. 21.

OPTOCOUPLER

Optocoupler in a hermetically sealed metal envelope. It has high reliability and can be used under severe conditions such as military or industrial applications.

An outstanding characteristic is the high common-mode rejection ratio.

QUICK REFERENCE DATA

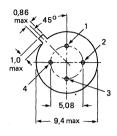
Diode			
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	lF IFRM	max. max.	100 mA 3 A
Transistor			
Collector-emitter voltage (open base)	V _{CEO}	max.	60 V
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	IC/IF	min.	0,3
Collector cut-off current (dark) VCE = 15 V; working voltage (d.c.) = 1,0 kV	ICEW	max.	200 nA
Isolation voltage d.c. value	VIORM	min.	1,0 kV
Common mode rejection ratio $I_C = 2 \text{ mA}$; $f = 10 \text{ kHz}$	CMRR	typ.	85 dB

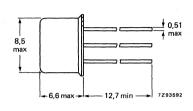
MECHANICAL DATA

SOT-104C (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT-104C.





Dimensions in mm



Pinning

pin 1 = anode pin 2 = cathode pin 3 = emitter pin 4 = collector

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	v_{R}	max.	5 V
Forward current d.c. (peak value); $t_D = 10 \mu s$; $\delta = 0.01$	l _F lerm	max. max.	100 mA 3 A
Total power dissipation up to $T_{amb} = 75 {}^{\circ}\text{C}$	P _{tot}	max.	150 mW
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	60 V
Emitter-collector voltage (open base)	V _{ECO}	max.	7 V
Collector current	IC	max.	100 mA
Total power dissipation up to Tamb = 75 °C	P _{tot}	max.	150 mW

Optocoupler

Total power dissipation			
up to T _{amb} = 75 °C	P _{tot}	max. 300) mW
Storage temperature	T _{stg}	-65 to +150	o o C
Operating ambient temperature	T _{amb}	-55 to +12	oC

THERMAL RESISTANCE

From junction to ambient in free air			
diode	R _{th j-a}	max.	330 K/W
transistor	R _{th j-a}	max.	330 K/W

CHARACTERISTICS

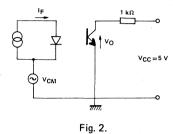
 $T_j = 25$ °C unless otherwise specified

Diode

Diode			
Forward voltage I _F = 10 mA	VF	typ. max.	1,15 V 1,3 V
Forward voltage IF = 2 mA; T _{amb} = 0 °C to 70 °C	V _F	max.	1,2 V
Reverse current V _R = 5 V	IR	typ. max.	1 μA 100 μA
Transistor			
Collector-emitter breakdown voltage open base; I _C = 1 mA	V _(BR) CEO	min.	60 V
Emitter-collector breakdown voltage open base; IE = 0,1 mA	V _{(BR)ECO}	min.	7 V
Collector cut-off current (dark) VCE = 20 V	ICEO	typ. max.	5 nA 100 nA
V _{CE} = 20 V; T _a = 70 °C	ICEO	max.	10 μΑ
D.C. current gain $I_C = 10 \text{ mA}$; $V_{CE} = 5 \text{ V}$	hFE	typ.	600
Optocoupler			
Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	IC/IF	min. typ.	0,4 0,8
$I_F = 10 \text{ mA; } V_{CE} = 5 \text{ V}$	IC/IF	typ.	1,0
Switching times $I_C = 2 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 100 \ \Omega$ $Turn-on time$ $Turn-off time$	t _{on} toff	typ. typ.	5 μs 5 μs
Isolation voltage, d.c. value between shorted input leads and shorted output leads	Viorm	min.	1,0 kV
Collector cut-off current (dark) V _{CC} = 15 V; working voltage (d.c.) = 1 kV			
$T_j = 25 ^{\circ}\text{C}$ $T_j = 70 ^{\circ}\text{C}$ (see Fig. 3)	ICEW	max. max.	200 nA* 50 μA*
Insulation resistance between input and output $V_{1O} = 500 \text{ V}$	RIO	min. typ.	$10^{11} \Omega$ $10^{12} \Omega$
Capacitance between input and output V = 0; f = 1 MHz	CIO	typ.	1 pF

^{*} As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

Common mode rejection ratio I_C = 2 mA; f = 10 kHz (see Fig. 2)



CMRR

typ.

85 dB

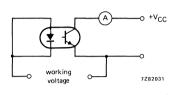


Fig. 3

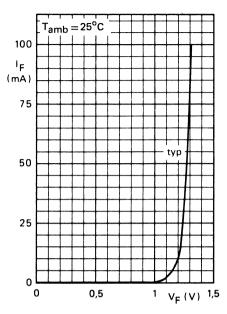
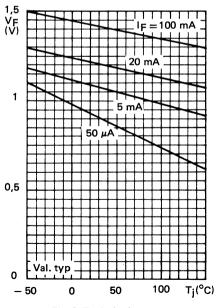


Fig. 4 Typical values.







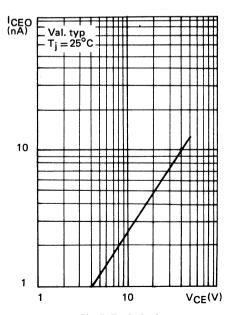
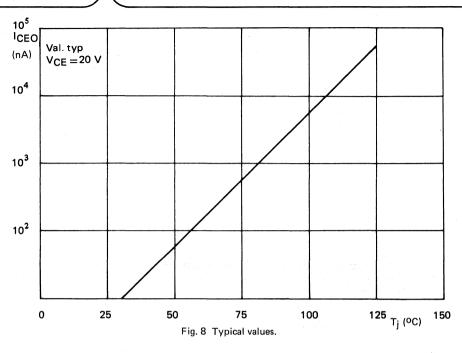


Fig. 7 Typical values.



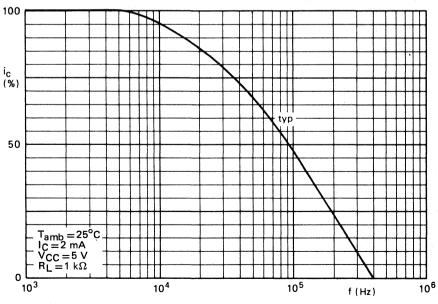


Fig. 9 Typical values.

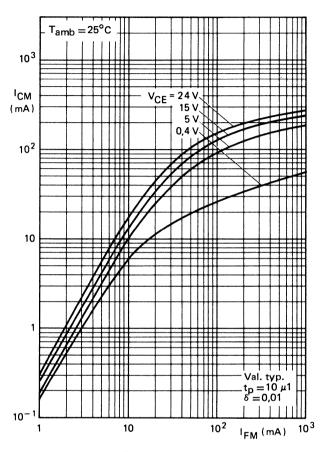


Fig. 10 Typical values.

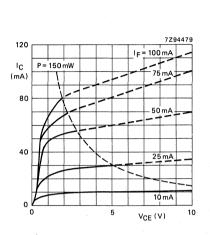


Fig. 11 T_{amb} = 25 °C; typical values.

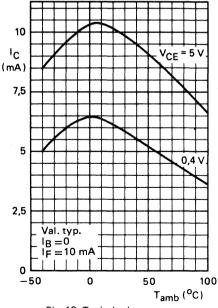


Fig. 13 Typical values.

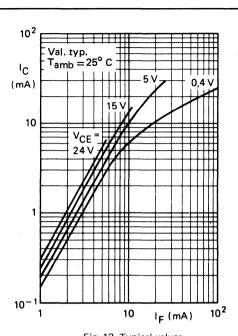


Fig. 12 Typical values.

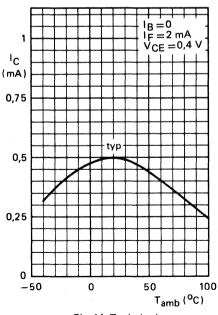


Fig. 14 Typical values.

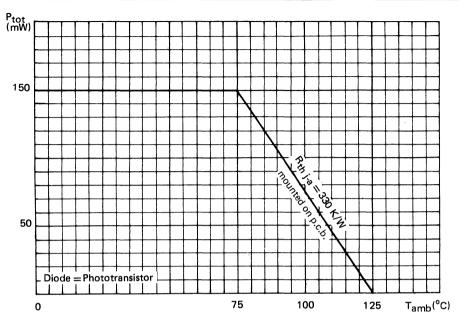


Fig. 15 Typical values.

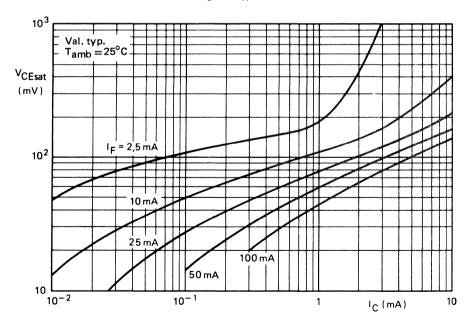


Fig. 16 Typical values.

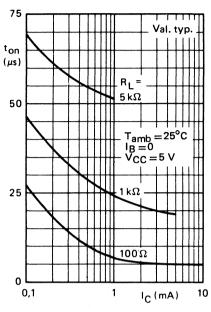


Fig. 17 Typical values.

Fig. 18 Typical values.

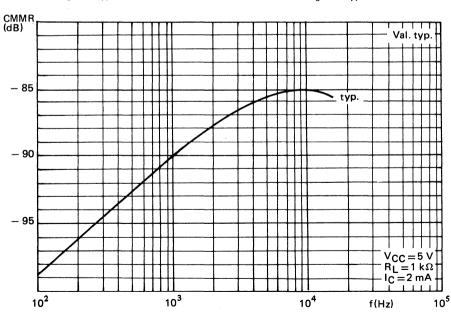


Fig. 19 T_{amb} = 25 °C; typical values.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAIAs diode and a silicon n-p-n photo-transistor. Hermetically sealed in a SOT-18F envelope, the CNX91 and CNX92 are intended for professional applications.

The difference between the two types is the pinning of the phototransistor.

QUICK REFERENCE DATA

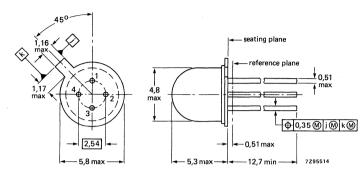
Diode			
Continuous reverse voltage	٧ _R	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	lF lFRM	max. max.	100 mA 2,5 A
Transistor			
Collector-emitter voltage (open base)	VCEO	max.	50 V
Collector current	IC	max.	100 mA
Optocoupler			
Leakage current under working voltage 500 V d.c. value VCF = 15 V			
T _i = 25 °C	^I CEW	max.	200 nA
$T_j = 70 ^{\circ}\text{C}$	ICEW	max.	100 μA
Isolation voltage d.c. value	V _{IORM}	min.	0,8 kV
Common mode rejection ratio $I_C = 2 \text{ mA}$; $f = 10 \text{ kHz}$	CMRR	min.	80 dB

MECHANICAL DATA

SOT-18F (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT-18F.



Dimensions in mm



Pin reference

CNX91

pin 1 = anode pin 2 = collector pin 3 = emitter pin 4 = cathode

CNX92

max.

pin 1 = anode pin 2 = emitter pin 3 = collector pin 4 = cathode

5 V

-55 to +125 °C

260 °C

RATINGS

Continuous reverse voltage

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Forward current			
d.c.	1 _F	max.	100 mA
(peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	^I FRM	max.	2,5 A
Transistor			
Collector-emitter voltage (open base)	v_{CEO}	max.	50 V
Emitter-collector voltage (open base)	VECO	max.	7 V
Collector current	IC	max.	100 mA
Optocoupier			
Total power dissipation			
up to T _{amb} = 25 °C	P _{tot}	max.	230 mW
Storage temperature	T _{stg}	-65 t	o +150 °C

 V_R

Tamb

Tsld

Soldering temperature

Operating ambient temperature

2 mm from the seating plane; < 10 s

		<u> </u>		
THERMAL RESISTANCE				
From junction to ambient in free air diode	Rth j-a	max.	600 K	
transistor	R _{th j-a}	max.	500 K	/ VV
From junction to case diode transistor	R _{th j-c} R _{th j-c}	max. max.	300 K, 200 K,	
CHARACTERISTICS				
T_j = 25 °C unless otherwise specified				
Diode				
Forward voltage				
IF = 2 mA	٧F	max.	1,5 V	
IF = 10 mA	VF	max.	1,65 V	
IF = 50 mA	٧F	max.	1,80 V	
Reverse current				
V _R = 5 V	^I R	max.	100 μ	
Diode capacitance	Cd	typ.	200 pF	=
Transistor				
Collector-emitter breakdown voltage open base; I _C = 1 mA	V _(BR) CEO	min.	50 V	
Emitter-collector breakdown voltage open base; $I_E = 0.1 \text{ mA}$	V _{(BR)ECO}	min.	7 V	
Collector cut-off current (dark) VCE = 50 V	ICEO	typ. max.	5 n/	-
V _{CE} = 5 V	ICEO	max.	10 n/	
Optocoupler				
Collector current I _F = 10 mA; V _{CE} = 0,4 V	IC	min. max.	3 m 20 m	
Saturation voltage $I_F = 50 \text{ mA}$; $I_C = 10 \text{ mA}$	VCEsat	max.	0,4 V	
Switching times				
$I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100 \Omega$		typ.	2 μs	;
Delay time	t _d	max.	4 μs	
Rise time	t _r	typ.	4 μs	
	-1	max.	5 μs	3
Storage time	t _S	typ. max.	0,4 μs 0,5 μs	
Fall time	tf	typ. max.	4 μs 5 μs	
Isolation voltage, d.c. value			,	
connected between shorted input leads and shorted output leads	VIORM	min.	0,8 k\	/

CNX91 CNX92

Collector cut-off current (dark) V_{CE} = 15 V; working voltage (d.c.) = 500 V T_i = 25 °C 200 nA ICEW max. $T_{j} = 70 \text{ oc}$ **ICEW** max. 100 µA (see Fig. 3) Insulation resistance between input and output $V_{10} = 500 \text{ V}$ $10^{12} \Omega$ rio min. Capacitance between input and output 1 pF typ. V = 0; f = 1 MHzCio 2 pF max. Common mode rejection ratio 80 dB min. $I_{C} = 2 \text{ mA}; f = 10 \text{ kHz}$ **CMRR** 90 dB typ. (see Fig. 2)

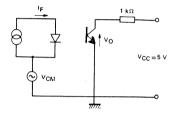


Fig. 2.

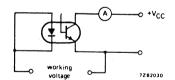


Fig. 3.

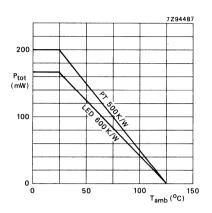


Fig. 4 Power derating curve.

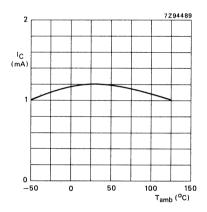


Fig. 6 $I_F = 2 \text{ mA}$; $V_{CE} = 5 \text{ V}$; typical values.

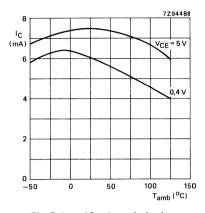


Fig. 5 $I_F = 10 \text{ mA}$; typical values.

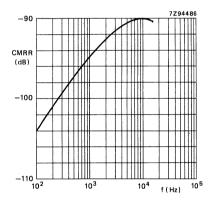


Fig. 7 I_C = 2 mA, V_{CC} = 5 V; R_L = 1 k Ω ; typical values.

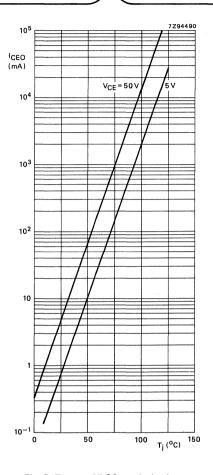


Fig. 8 T_{amb} = 25 °C; typical values.

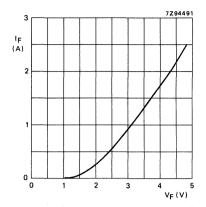


Fig. 9 T_{amb} = 25 °C; δ = 0,01; T_{on} = 10 μ s; typical values.

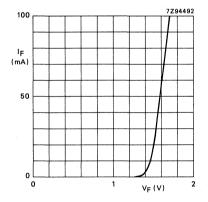


Fig. 10 $T_{amb} = 25$ °C; typical values.

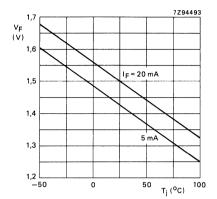


Fig. 11 Typical values.

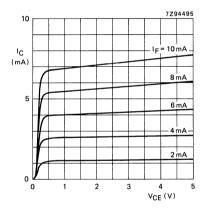


Fig. 13 Typical values.

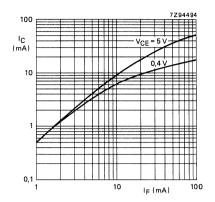


Fig. 12 $T_{amb} = 25$ °C; typical values.

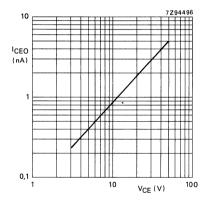


Fig. 14 $T_j = 25$ °C; typical values.

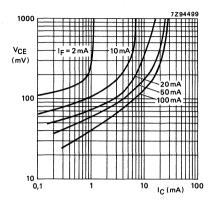


Fig. 15 T_{amb} = 25 °C; V_{CC} = 5 V; typical values.

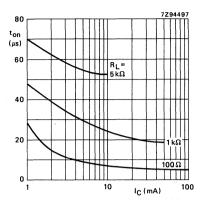


Fig. 16 V_{CC} = 5 V; typical values.

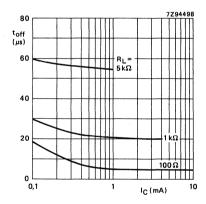


Fig. 17 T_{amb} = 25 °C; typical values.

OPTOCOUPLER

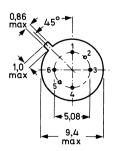
Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor with accessible base. Hermetically encapsulated in a metal envelope. The CNY50 is intended for professional applications.

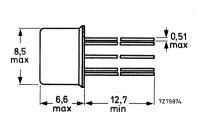
QUICK REFERENCE DATA

Diode						
Continuous reverse voltage		v_R	max.	5	٧	
Forward current						
d.c.		۱F	max.	100		
(peak value); $t_p = 10 \mu s$; $\delta = 0.01$		FRM	max.	3	Α	
Total power dissipation up to $T_{amb} = 75$ °C		P _{tot}	max.	150	mW	
Transistor						
Collector-emitter voltage (open base)		v_{CEO}	max.	50	V	
Total power dissipation up to T _{amb} = 75 °C		P _{tot}	max.	150	mW	
Optocoupler						
Output/input d.c. current transfer ratio (C.T.R.)			min.	0,25		
$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}; (I_B = 0)$	CNY50-1	I _C /I _F	max.	1,0		
			min.	0,4		
	CNY50-2	IC/IF	max.	1,6		
Collector cut-off current (dark)				.,0		
V _{CC} = 15 V; working voltage (d.c.) = 1 kV		ICEW	max.	200	nA	
Isolation voltage(d.c.)		v_{IORM}	min.	1,5	kV	

MECHANICAL DATA

Fig. 1 SOT-104B.





Dimensions in mm



Lead reference

pin 1 = emitter

pin 2 = base

pin 3 = collector

pin 4 = anode

pin 5 = N.C.

pin 6 = cathode

Maximum lead diameter guaranteed only for 12,7 mm.

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Diode				
Continuous reverse voltage	v_R	max.	5	٧
Forward current			400	
d.c. (peak value); $t_D = 10 \ \mu s$; $\delta = 0.01$	I _F IFRM	max. max.		mA A
Total power dissipation up to $T_{amb} = 75 ^{\circ}\text{C}$ (see Fig. 2)		max.		mW
4.11.2	P _{tot}	max.		
Operating junction temperature	Тj	max.	125	οС
Transistor				
Collector-base voltage (open emitter)	V_{CBO}	max.	70	٧
Collector-emitter voltage (open base)	V_{CEO}	max.	50	٧
Emitter-collector voltage (open base)	VECO	max.	7	٧
Collector current (d.c.)	lc ,	max.	100	mΑ
Total power dissipation up to T _{amb} = 75 °C	P _{tot}	max.	150	mW
Operating junction temperature	T_{j}	max.	125	оС
Optocoupler				
Total power dissipation up to T _{amb} = 75 °C	P _{tot}	max.	300	mW
Storage temperature	T _{stg}	-65 to +	150	οС
Operating ambient temperature	T _{amb}	-55 to +	125	οС
THERMAL DEGICTANCE				

THERMAL RESISTANCE

From junction to ambient in free air			
diode	R _{th i-a}	=	330 K/W
transistor	R _{th j-a}	=	330 K/W

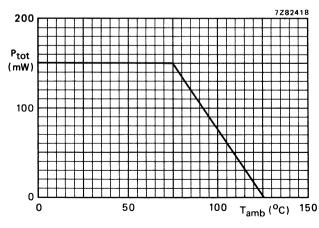


Fig. 2 Power/temperature derating curve for diode and transistor.

Optocoupler CNY50

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Diode				
Forward voltage				
$I_F = 2 \text{ mA}$; $T_{amb} = 0 \text{ °C to } 70 \text{ °C}$		٧ _F	<	1,2 V
I _F = 10 mA		VF	typ.	1,15 V 1,3 V
Reverse current			tun	1
V _R = 5 V		IR	typ. <	1 μA 20 μA
Diode capacitance				
$V_R = 0$; $f = 1 MHz$		C_d	typ.	75 pF
Transistor (diode: $1_F = 0$)				
Collector-base breakdown voltage				
open emitter; I _C = 0,1 mA		V(BR)CBO	>	70 V
Collector-emitter breakdown voltage open base; I _C = 1 mA		Vanasa	>	50 V
Emitter-collector breakdown voltage		V(BR)CEO		30 V
open base; I _F = 0,1 mA		V(BR)ECO	>	7 V
Collector cut-off current (dark)		(611/200		
I _E = 0; V _{CB} = 10 V		ICBO	<	20 nA
I _B = 0; V _{CF} = 20 V		ICEO	typ.	5 nA
I _B = 0; V _{CE} = 20 V; T _{amb} = 70 °C		ICEO	< <	100 nA 10 μA
D.C. current gain		-CEO		יישן
I _C = 10 mA; V _{CE} = 5 V		hFE	min.	200
			typ.	600
Optocoupler $(I_B = 0)$				
Output/input d.c. current transfer ratio (C.T.R.)			min.	0,25
$I_F = 10 \text{ mA; } V_{CE} = 0.4 \text{ V}$	CNY50-1	IC/IF	typ. max.	0,4 1,0
			min.	0.4
	CNY50-2	IC/IF	typ.	0,4
		10/11	max.	1,6
Collector cut-off current (dark) see Fig. 3				
V_{CC} = 15 V; working voltage (d.c.) = 1 kV T _i = 25 °C		locus		200 nA
$T_i = 70 ^{\circ}\text{C}$		ICEW ICEW	< <	200 πA 100 μA
Isolation voltage, d.c. value		CLW		,
between shorted input				
and shorted output terminals		VIORM	min.	1,5 kV
Capacitance between input and output			typ.	1 pF
$I_F = 0$; $V = 0$; $f = 1 \text{ MHz}$		Cio	max.	2,5 pF
				•

Insulation resistance between input and output

± V_{IO} = 500 V

Switching times $I_F = 10 \text{ mA; } V_{CC} = 5 \text{ V; } R_L = 2 \text{ k}\Omega$

rıo

> 1

 $\begin{array}{ccc} 10^{1\,1} & \Omega \\ 10^{1\,2} & \Omega \end{array}$

typ.

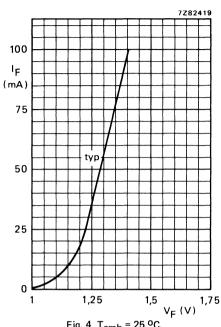
0^{1 2} Ω 20 μs

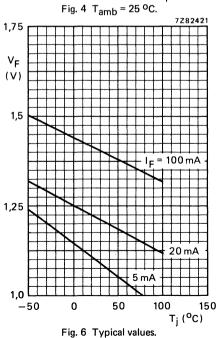
70 μs

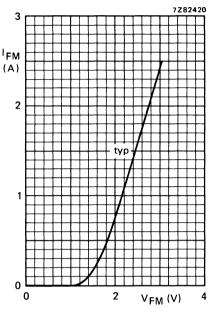
t_{on} toff typ. typ.

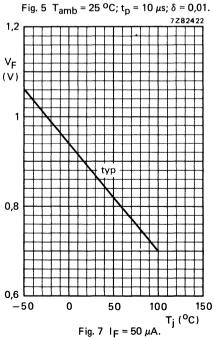
working voltage 7z82030

Fig. 3.









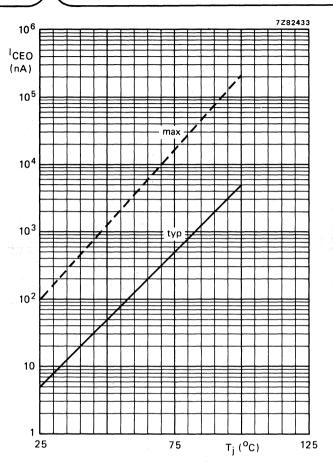
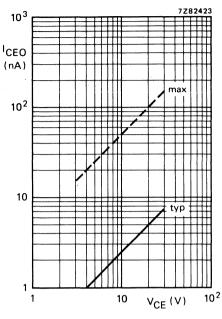
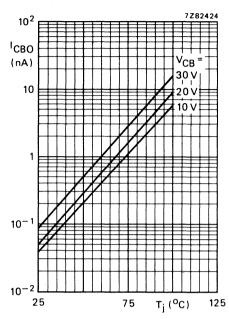
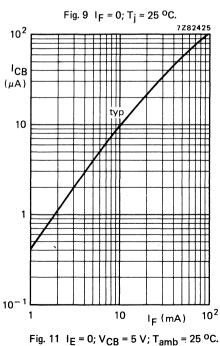
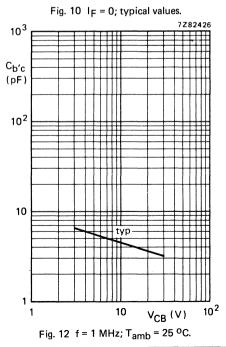


Fig. 8 $I_F = 0$; $V_{CE} = 20 \text{ V}$.









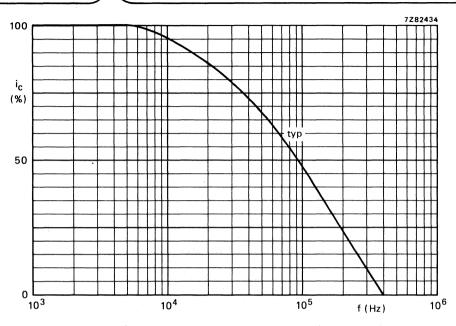


Fig. 13 I_B = 0; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 k Ω ; T_{amb} = 25 °C.

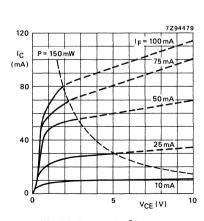


Fig. 14 T_{amb} = 25 °C; typical values.

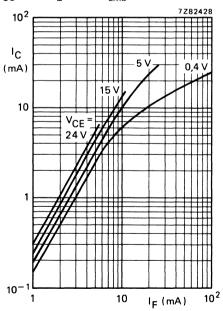


Fig. 15 $T_{amb} = 25$ °C; typical values.

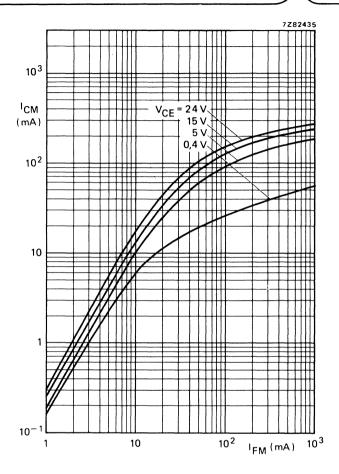


Fig. 16 T_{amb} = 25 °C; t_p = 10 μ s; δ = 0,01; typical values.

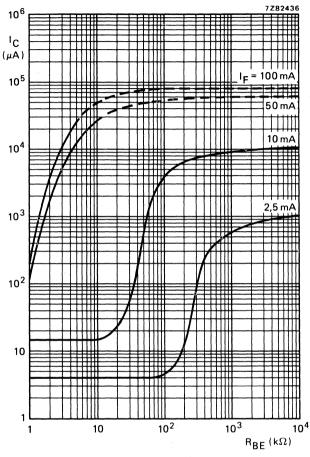
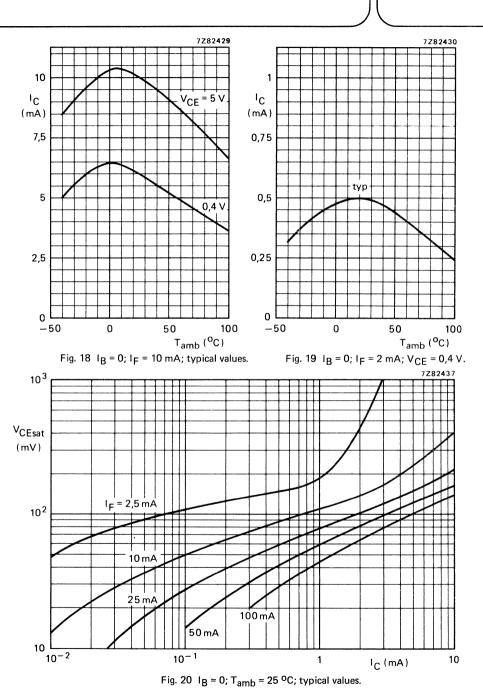


Fig. 17 $I_B = 0$; $V_{CE} = 5 V$; $T_{amb} = 25 \, {}^{o}C$; typical values.



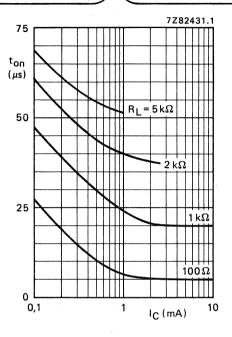


Fig. 21 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See Fig. 23).

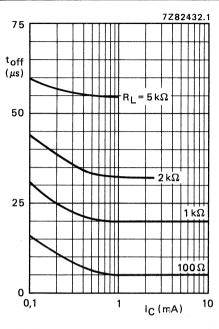
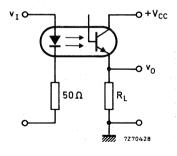


Fig. 22 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See Fig. 23).



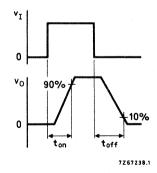


Fig. 23 Switching circuit and waveforms.

SECTION B2

Photosensitive semiconductors



SILICON PHOTOTRANSISTOR

N-P-N silicon phototransistor in epoxy resin encapsulation intended for optical coupling and encoding. The base is inaccessible. Combination with IR emitter diode CQY58A is recommended.

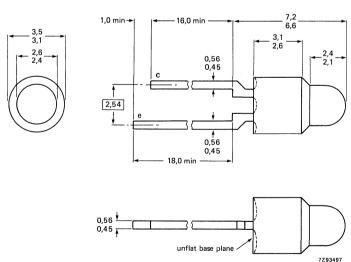
QUICK REFERENCE DATA

Collector-emitter voltage Collector current (d.c.) Total power dissipation up to T _{amb} = 25 °C		V _{CEO} I _C P _{tot}	max. max. max.	50 V 25 mA 100 mW
Collector dark current VCE = 30 V; E = 0		I _{CEO(D)}	<	100 nA
Collector light current $V_{CE} = 5 \text{ V}$; $E_e = 1 \text{ mW/cm}^2$; $\lambda_p = 930 \text{ nm}$	BPW22A-1 BPW22A-2	ICEO(L)	•	to 8 mA to 25 mA
Wavelength at peak response		λ_{p}	typ.	800 nm

MECHANICAL DATA

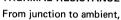
Dimensions in mm

Fig. 1 SOD-53F.



RATINGS

Limiting values in accordance with the Absolute Maximum	System (IEC 134))	
Collector-emitter voltage	VCEO	max.	50 V
Emitter-collector voltage	VECO	max.	7 V
Collector current			
d.c.	lc	max.	25 mA
peak value	^I CM	max.	50 mA
Total power dissipation up to $T_{amb} = 25$ °C	P _{tot}	max.	100 mW
Storage temperature	T _{stg}	-55 to	+ 100 °C
Junction temperature	Τį	max.	100 °C
Lead soldering temperature	•		
$>$ 1,5 mm from the seating plane; t_{sld} $<$ 7 s	T_{sld}	max.	260 °C
THERMAL RESISTANCE			



device mounted on printed-circuit board R_{th j-a} = 750 K/W

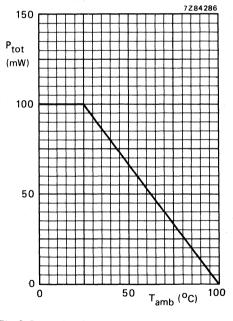


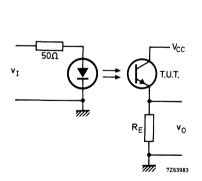
Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS

turn-on time

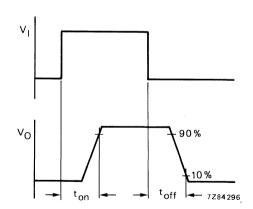
turn-off time

T _j = 25 °C unless otherwise specified					
Collector dark current VCE = 30 V; E = 0		ICEO(D)	<	100	nΑ
Collector light current					
$V_{CE} = 5 V; E_e = 1 \text{ mW/cm}^2; \lambda_p = 930 \text{ nm}$	BPW22A-1 BPW22A-2	CEO(L)		1,5 to 8 5 to 25	
Collector-emitter saturation voltage					
$I_C = 1 \text{ mA}; E_e = 1 \text{ mW/cm}^2; \lambda_p = 930 \text{ nm}$		V _{CEsat}	<	0,4	٧
Wavelength at peak response		λ_{p}	typ.	800	nm
Bandwidth at half height		$\dot{\Delta\lambda}$	typ.	400	nm
Half sensitivity angle		$\theta_{1/2}$	typ.	201	0
Switching times (see Figs 3, 4, 9 and 10)					
$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_E = 100 \Omega; T_{amb} =$	25 °C				
turn-on time		^t on	typ.	3	μs
turn-off time		^t off	typ.	3	μs



 I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 1 k Ω ; T_{amb} = 25 °C

Fig. 3 Switching circuit with light emitting diode CQY58A. T.U.T. = BPW22A.



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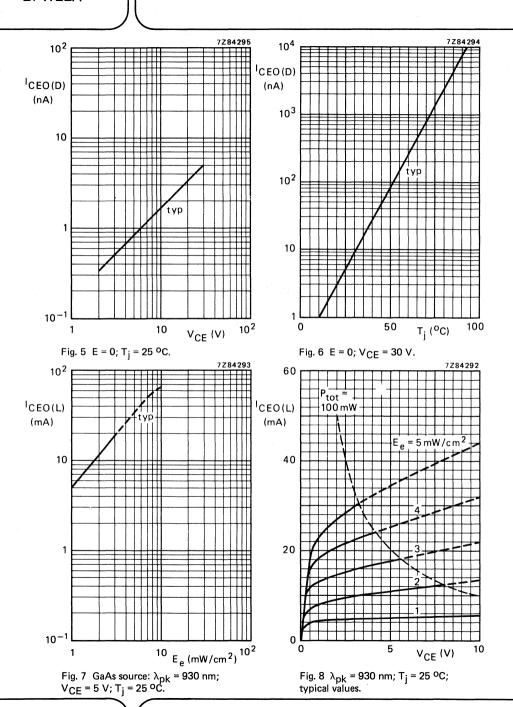
typ.

typ.

12,0 μs

12,0 μs

Fig. 4 Input and output switching waveforms.



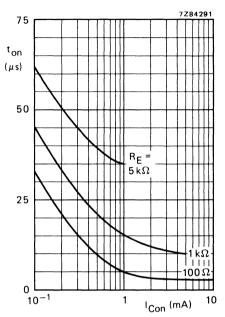


Fig. 9 V_{CC} = 5 V; T_{amb} = 25 o C; typical values; see also Figs 3 and 4.

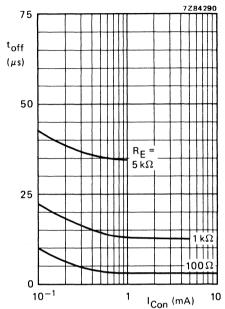


Fig. 10 V_{CC} = 5 V; T_{amb} = 25 o C; typical values; see also Figs 3 and 4.

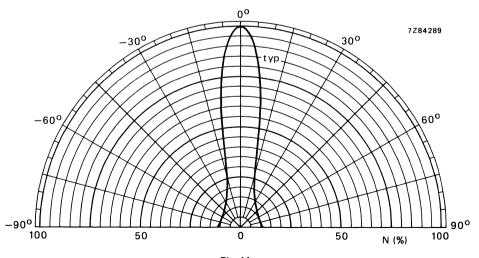


Fig. 11.

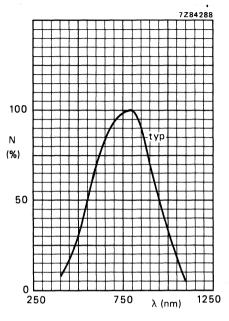


Fig. 12 Spectral response.

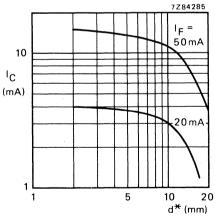


Fig. 14 $V_{CE} = 5 V$; $T_{amb} = 25 °C$; typical values.

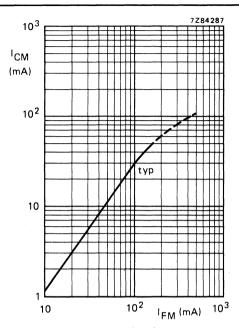


Fig. 13 $V_{CE} = 5 \text{ V}$; $t_p (I_{FM}) = 10 \mu s$; T = 1 ms; $d^* = 10 \text{ mm}$; $T_{amb} = 25 \text{ °C}$.

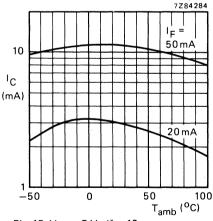


Fig. 15 $V_{CE} = 5 V$; $d^* = 10 mm$; typical values.

^{*} d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

HIGH-SPEED SILICON PHOTO P-I-N DIODE

The BPW50 is optimized for applications with remote control systems. Combination with IR emitter diode CQY89A-2 or CQW89A is recommended. If combined with high-speed IR emitting diode CQW89A, carrier frequencies of up to 1 MHz can be applied.

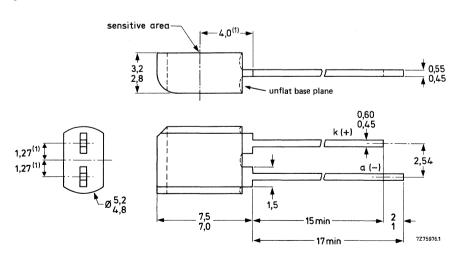
QUICK REFERENCE DATA

Continuous reverse voltage	v_R	max.	32 V
Total power dissipation up to $T_{amb} = 47,5$ °C	P_{tot}	max.	150 mW
Junction temperature	Тj	max.	100 °C
Dark reverse current $V_R = 10 \text{ V}$; $E_e = 0$	I _{R(D)}	<	30 nA
Ligth reverse current $V_R = 5 \text{ V}$; $E_e = 1 \text{ mW/cm}^2$; $\lambda = 930 \text{ nm}$	I _{R(L)}	>	30 μΑ
Wavelength at peak response $V_R = 5 V$ Sensitive area	λ _p Α	typ. typ.	930 nm 5 mm ²

MECHANICAL DATA

Fig. 1 SOD-67.

Dimensions in mm



(1) Reference for the positional tolerance of the sensitive area.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V _R .	max. 32	. V
Total power dissipation up to T _{amb} = 47,5 °C	P _{tot}	max. 150	mW
Storage temperature	T_{stg}	-30 to + 100	oC.
Junction temperature	T_{j}	max. 100	· oC
Lead soldering temperature			
up to the seating plane; $t_{ m sld}$ $<$ 10 s	T_{sld}	max. 260	o o c

THERMAL RESISTANCE

R_{th j-a} From junction to ambient in free air 350 K/W

CHARACTERISTICS

T_i = 25 °C

Dark reverse current			tvp.	2 nA
$V_R = 10 V; E_e = 0$		R(D)	<	30 nA
Light reverse current				

30 µA $V_R = 5 V; E_e = 1 \text{ mW/cm}^2; \lambda = 930 \text{ nm}$ IR(L) typ. 45 µA

Reverse voltage $I_R = 0.1 \text{ mA}; E_e = 0$ 32 V ٧R Wavelength at peak response

 $V_R = 5 V$ 930 nm λρ typ. Diode capacitance 17 pF typ.

 $V_R = 3 V$ C_d < 30 pF

 $V_R = 0$ C^{4} typ. 50 pF

Light switching times (see Figs 2 and 3)

Rise time and fall time $V_{KK} = 10 \text{ V}; R_A = 1 \text{ k}\Omega$ 50 ns tr, tf typ.

V_{KK}(+) ٧ı CQY11C v_o 90%

Fig. 2 Switching circuit.

7275734

Fig. 3 Input and output switching waveforms.

10%

7Z63982

348

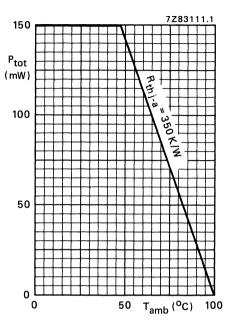


Fig. 4 Maximum permissible power dissipation as a function of temperature.

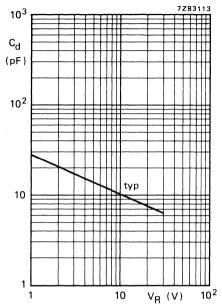


Fig. 5 $T_{amb} = 25$ °C.

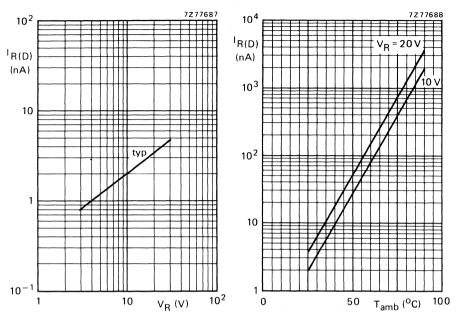


Fig. 6 E = 0; $T_{amb} = 25$ °C.

Fig. 7 E = 0; typical values.

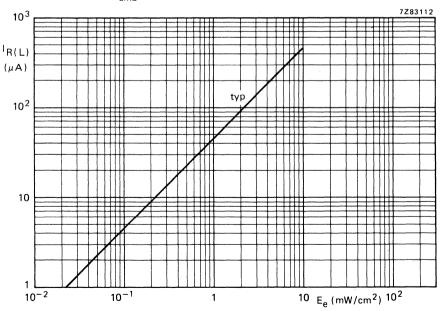


Fig. 8 $V_R = 5 V$; $\lambda = 930 \text{ nm}$; $T_{amb} = 25 \text{ }^{o}\text{C}$.

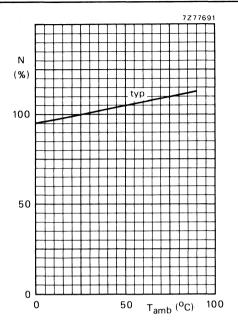


Fig. 9 $E_e = 1 \text{ mW/cm}^2$; $\lambda = 930 \text{ nm}$.

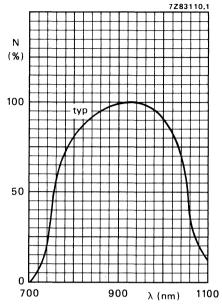


Fig. 10 $V_R = 5 V$; $T_{amb} = 25 °C$.

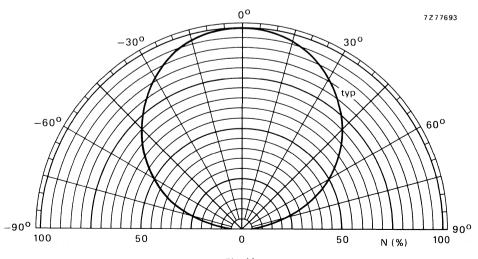


Fig. 11.



SILICON PHOTO-DARLINGTON TRANSISTOR

 $\hbox{N-P-N subminiature photo-darlington transistor mounted in a SOT-71 envelope.} \\$

This envelope is designed for assembly onto printed circuit boards.

QUICK REFERENCE DATA

Collector-emitter voltage	V _{CEO}	max.	30 V
Collector current (peak value)	1 _{CM}	max.	150 mA
Junction temperature	Тj	max.	150 °C
Collector dark current V _{CE} = 10 V; E = 0	ICEO	max.	100 nA
Collector current VCE = 5 V; E = 1 mW/cm ²			
(see note 1)	IC	min.	15 mA
Wavelength of maximum sensitivity $E = 1 \text{ mW/cm}^2$	λ	typ.	800 nm

MECHANICAL DATA

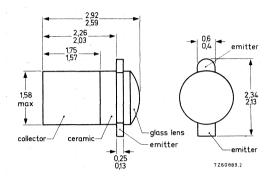
SOT-71A (see Fig. 1).

Dimensions in mm

MECHANICAL DATA

Fig. 1 SOT-71A.

Dimensions in mm



Limiting values in accordance with the Absolute Maximum Systematics	em (IEC 134)		
Collector-emitter voltage	VCEO	max.	30 V
Emitter-collector voltage	VECO	max.	7 V
Collector current (d.c.)	IC .	max.	100 mA
Collector current (peak value) $t_p = 100 \ \mu s; \ \delta = 0,1$	ICM	max.	150 mA
Total power dissipation up to Tamb = 55 °C when mounted on a printed circuit board	D. .	max.	100 mW
	P _{tot}		
Storage temperature	T _{stg}	-65 to	+150 °C
Junction temperature	T_{j}	max.	150 °C
Lead soldering temperature; < 10 s	T _{sld}	max.	240 °C
THERMAL RESISTANCE			
Thermal resistance from junction to ambient	R _{th j-a}	max.	2000 K/W
Thermal resistance from junction to ambient when device			
is mounted on a P.C.B.	R _{th j-a}	max.	950 K/W

CHARACTERISTICS				
T _j = 25 °C unless otherwise stated				
Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$	V _{(BR)CEO}	min.	30	V
Emitter-collector breakdown voltage $I_C = 0.1 \text{ mA}$	V(BR)ECO	min.	7	٧
Collector dark current $V_{CE} = 10 \text{ V}$; $E = 0$	ICEO	typ. max.	25 100	nA nA
$V_{CE} = 10 \text{ V; E} = 0; T_j = 100 \text{ °C}$	^I CEO	typ.	200	μΑ
Collector current VCE = 5 V; E = 1 mW/cm ² (see note 1)	IC	min. typ.		mA mA
Collector-emitter saturation voltage IC = 2 mA; E = 1 mW/cm² (see note 1) Switching times (see Fig. 2 and 3)	VCEsat	max.	1,1	V
I _C = 5 mA; V_{CC} = 5 V; R _L = 100 Ω Delay time	t _d	typ.	25	μs
Rise time	t _r	typ. max.	60 300	•
Storage time	t _S	typ.	2,0	μs
Fall time	tf	typ. max.	40 200	•
Wavelength of maximum sensitivity E = 1 mW/cm ²	λ	typ.	800	nm
Bandwidth of half sensitivity E = 1 mW/cm ²	Δλ	typ.	400	nm
Halve sensitivity angle	$\theta \frac{1}{2}$	typ.	20	0
Sensitive area	Α	typ.		mm²

Note 1: For this measurement, the source is a GaAs diode (930 nm).

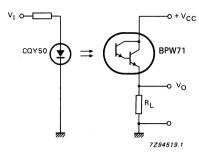


Fig. 2 Measuring circuit.

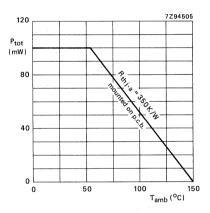


Fig. 4 Power derating curve.

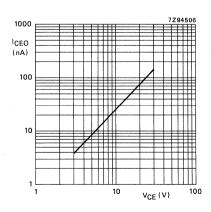


Fig. 5 $T_j = 25$ °C; typical values.

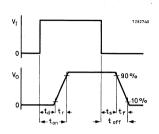


Fig. 3 Waveforms.

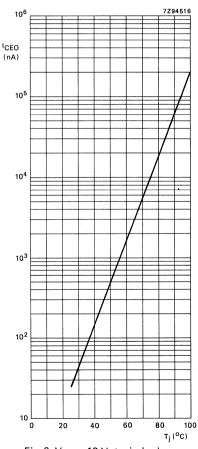


Fig. 6 V_{CE} = 10 V; typical values.

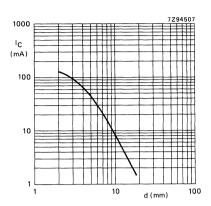


Fig. 7 V_{CE} = 5 V; I_F = 20 mA; T_{amb} = 25 °C; typical values.

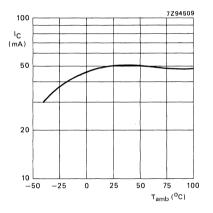


Fig. 9 $V_{CE} = 5 \text{ V}$; $I_F = 20 \text{ mA}$; typical values.

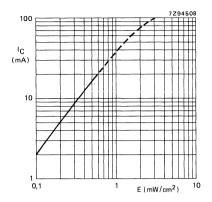


Fig. 8 V_{CE} = 5 V; source λ = 930 nm; typical values.

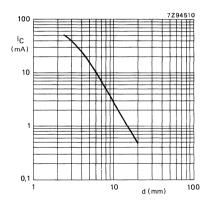
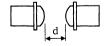


Fig. 10 V_{CE} = 5 V; I_F = 10 mA; T_{amb} = 25 °C; d = 5 mm; typical values.



(coupled with CQY50)

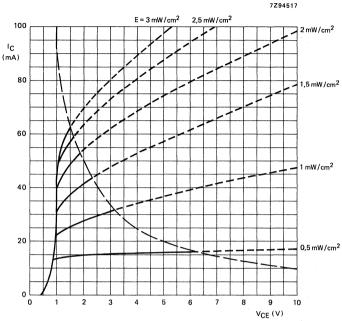


Fig. 11 $T_{amb} = 25$ °C; source $\lambda = 930$ nm; typical values.

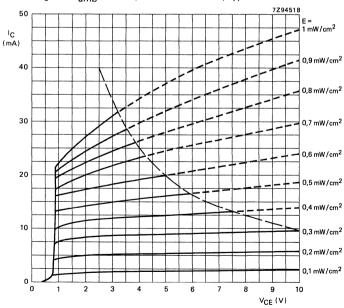


Fig. 12 T_{amb} = 25 °C; source λ = 930 nm; typical values.

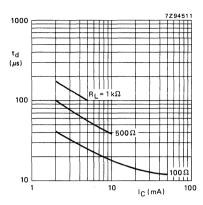


Fig. 13 $T_{amb} = 25$ °C; $V_{CC} = 5$ V; typical values.

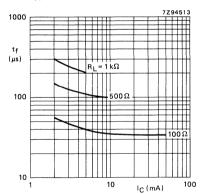


Fig. 15 $T_{amb} = 25$ °C; $V_{CC} = 5$ V; typical values.

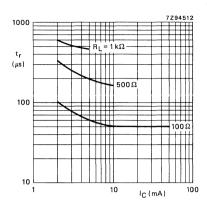


Fig. 14 $T_{amb} = 25$ °C; $V_{CC} = 5$ V; typical values.

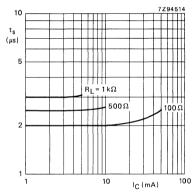


Fig. 16 T_{amb} = 25 °C; V_{CC} = 5 V; typical values.

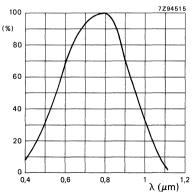


Fig. 17 Typical values.

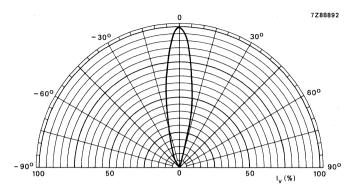


Fig. 18.

SILICON PLANAR EPITAXIAL PHOTOTRANSISTORS

General purpose n-p-n silicon phototransistors in a TO-18 envelope. The BPX25 has a lens, the BPX29 has a plane window. Combination with CQY11B and CQY11C or CQY49B and CQY49C is recommended.

QUICK REFERENCE DATA

Collector-emitter voltage		v_{CEO}	max.	50 V
Collector current (peak value)		CM	max.	200 mA
Junction temperature		Tj	max.	150 °C
Collector dark current $V_{CE} = 24 \text{ V}; E = 0$		ICEO	max.	100 nA
Collector light current VCE = 6 V; E = 1000 lux	BPX25 BPX29	Ic Ic	min. min.	4 mA 0,2 mA

MECHANICAL DATA

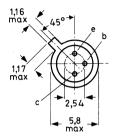
See Fig. 1.

Dimensions in mm

MECHANICAL DATA

Fig. 1a SOT-29/2.

Dimensions in mm



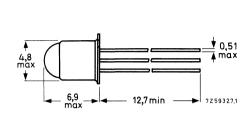
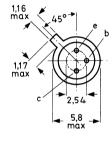
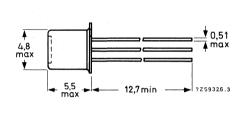


Fig. 1b SOT-29/1.

BPX29

BPX25





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage	V _{СВО}	max.	50 V
Collector-emitter voltage	VCEO	max.	50 V
Emitter-base voltage	VEBO	max.	7 V
Collector current (d.c.)	IC	max.	100 mA
Collector current (peak value); $t_p = 50 \mu s$; $\delta = 0,1$	ICRM	max.	200 mA
Total power dissipation			
up to T _{amb} = 25 °C	P _{tot}	max.	300 mW
Storage temperature	T _{stg}	-65 to	o +150 °C
Junction temperature	Tj	max.	150 °C

THERMAL RESISTANCE

Thermal resistance from			
junction to ambient	R _{th j-a}	max.	400 K/W
Thermal resistance from			
junction to case	R _{th j-c}	max.	150 K/W

CHARACTERISTICS

OTANAOTE MOTIOS				
T _j = 25 °C unless otherwise stated				
Collector dark current		tvn		10 nA
$V_{CE} = 24 \text{ V; E} = 0$	ICEO	typ. max.		100 nA
V_{CE} = 24 V; E = 0; T_j = 100 °C	ICEO	typ. max.		10 μA 100 μA
D.C. current gain				
$I_C = 2 \text{ mA}$; $V_{CE} = 6 \text{ V}$	hFE	typ.		500
Cut-off frequency				
Source: modulated GaAs: 0,4 mW/cm ²	٠.			200 111-
Load : optimum (50 Ω); V _{CE} = 24 V	fCO	typ.		200 kHz
Collector light current			BPX25	BPX29
V _{CE} = 6 V		min.	4,0	0,2 mA
E = 1000 lux (see note 1)	IC	typ.	10	0,6 mA
Switching times (see note 2)		tun	1,0	2,5 μs
Delay time	t _d	typ. max.	3,0	2,5 μs 5,0 μs
B:		typ.	1,5	2,5 μs
Rise time	t _r	max.	3,0	5,0 μs
Storage time	+	typ.	0,2	0,2 μs
otorugo time	t _S	max.	0,5	0,5 μs
Fall time	tf	typ.	1,5	3,5 μs
	·	max.	4,0	8,0 μs
Half sensitivity angle	$\theta \frac{1}{2}$	typ.	30	80 o
Wavelength at peak response	$\lambda_{\mathbf{p}}$	typ.	800	800 nm
Bandwidth at half height	Δλ	typ.	400	400 nm

Note 1: Source: tungsten filament lamp with $T_c = 2856 \text{ K}$

Note 2: Source : modulated GaAs: 0.4 mW/cm^2 load : optimum (50 Ω); $V_{CE} = 24 \text{ V}$

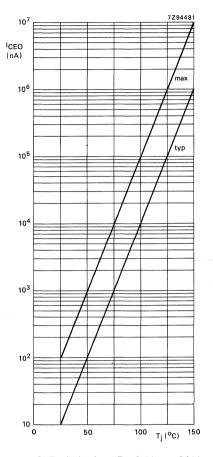


Fig. 2 Typical values; E = 0; $V_{CE} = 24 V$.

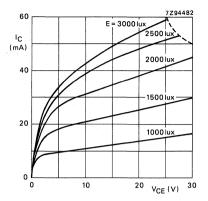


Fig. 3 BPX25; Typical values.

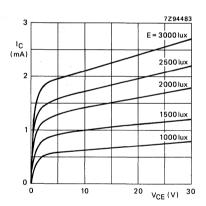


Fig. 4 BPX29; Typical values.

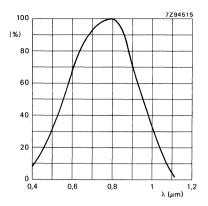


Fig. 5 Typical values.

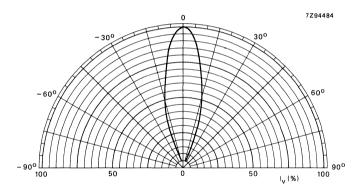


Fig. 6 BPX25; Typical values.

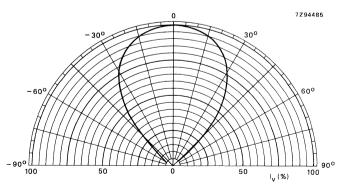


Fig. 7 BPX29; Typical values.



Unencapsulated photodiode for general purpose applications.

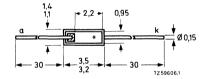
QUICK REFERENCE DATA

Reverse voltage	٧R	max.	18 V
Luminous current V _R = 15 V; E = 1000 lx	I _{Po}	typ.	14 μΑ
Dark reverse current at $V_R = 15 V$	۱ _R	<	0,5 μΑ
Wavelength at peak response	λ_{p}	typ.	800 nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.

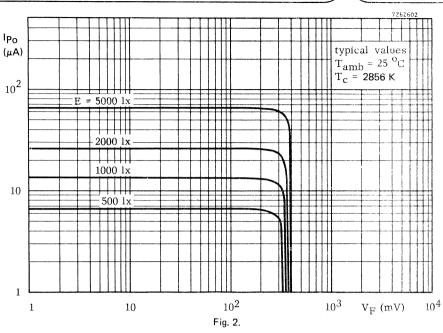


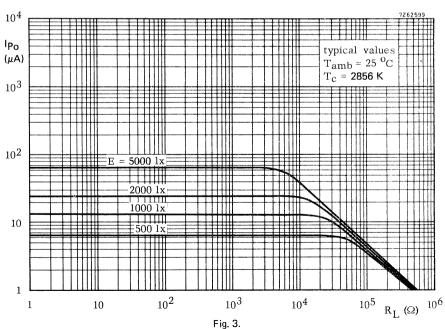
Slice thickness 0,27 mm

^{*} Sensitive area = $2.2 \times 0.95 \text{ mm}$.

RATINGS				
Limiting values in accordance with the Absolute Maximum System (I	EC 134)			
Reverse voltage	v_R	max.	18	٧
Forward current	ΙF	max.	5	mΑ
Dark reverse current	l _R	max.	2	mΑ
Storage temperature	T _{stg}	-65 to	+ 125	oC
Junction temperature	Tj	max.	125	oC
THERMAL RESISTANCE				
From junction to ambient in free air	R _{th j-a}	=	0,5	K/mW
CHARACTERISTICS				
T _{amb} = 25 °C unless otherwise specified				
Dark reverse current VR = 15 V	IR	typ.	0,01 0,5	•
$V_R = 15 \text{ V; } T_{amb} = 100 ^{\circ}\text{C}$	I _R	typ.	0,6 4,0	
Photovoltaic mode $E = 1000 \text{ lx; } T_C = 2856 \text{ K (equivalent to 4,75 mW/cm}^2\text{)}$ Light reverse current; $V = 0$	I ₁	> typ.		μΑ μΑ
Forward voltage; I = 0	٧F	> typ.	330 350	
Luminous current with external voltage* $V_R = 15 \text{ V}$; E = 1000 lx; $T_c = 2856 \text{ K}$ (equivalent to 4,75 mW/cm ²)	I _{Po}	> typ.	8,5 14	μΑ μΑ
Wavelength at peak response	λ_{D}	typ.	800	•
Diode capacitance; f = 500 kHz	۲	• •		
V _R = 15 V	c_d	typ.	90	pF
V _R = 0	c_d	typ.	300	pF
Cut-off frequency (modulated GaAs source)	f _{co}	typ.	500	kHz

^{*} The value of light current increases with temperature by an amount approximately equal to the increase in dark current.





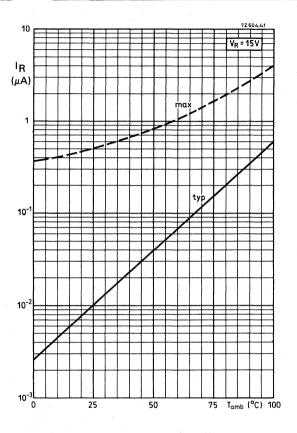


Fig. 4.

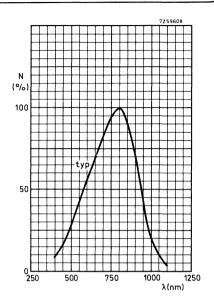


Fig. 5.

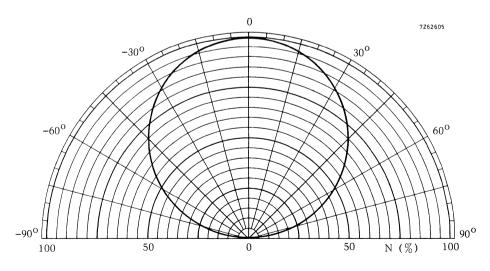


Fig. 6.



Unencapsulated photodiode for general purpose applications.

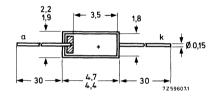
QUICK REFERENCE DATA

Reverse voltage	٧R	max.	18 V
Luminous current $V_R = 15 V$; E = 1000 Ix	I _{Po}	typ.	40 μΑ
Dark reverse current at $V_R = 15 V$	۱R	<	1 μΑ
Wavelength at peak response	$\lambda_{\mathbf{p}}$	typ.	800 nm

MECHANICAL DATA

Fig. 1.

Dimensions in mm

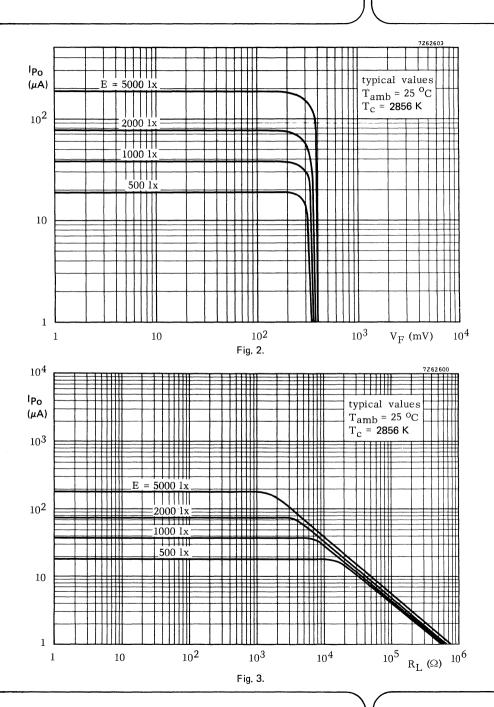


Slice thickness 0,27 mm

^{*} Sensitive area = 3,5 x 1,8 mm.

natings				
Limiting values in accordance with the Absolute Maximum System (IEC	C 134)			
Reverse voltage	V_{R}	max.	18	٧
Forward current	l _E	max.	10	mΑ
Dark reverse current	IR	max.	5	mA
Storage temperature	T _{stg}	-65 to +	125	оС
Junction temperature	Tj	max.	125	oC
THERMAL RESISTANCE				
From junction to ambient in free air	R _{th j-a}	=	0,5	K/mW
CHARACTERISTICS				
T _{amb} = 25 °C unless otherwise specified				
Dark reverse current VR = 15 V	I _R	typ.	0,02 1,0	μΑ μΑ
$V_R = 15 \text{ V; } T_{amb} = 100 ^{\circ}\text{C}$	IR	typ.	1,2 8,0	μΑ μΑ
Photovoltaic mode $E = 1000 \text{ lx}$; $T_c = 2856 \text{ K (equivalent to 4,75 mW/cm}^2$) Light reverse current; $V = 0$	11	> typ.		μΑ μΑ
Forward voltage; I = 0	٧ _F	> typ.	330 350	
Luminous current with external voltage* $V_R = 15 \text{ V}$; E = 1000 lx; $T_c = 2856 \text{ K}$ (equivalent to 4,75 mW/cm ²)	I _{Po}	> typ.		μΑ μΑ
Wavelength at peak response	$\lambda_{\mathbf{p}}$	typ.	800	•
Diode capacitance; f = 500 kHz V _R = 15 V V _R = 0	C _d	typ.	250 800	•
Cut-off frequency (modulated GaAs source)	f _{co}	typ.	500	kHz

^{*} The value of light current increases with temperature by an amount approximately equal to the increase in dark current.



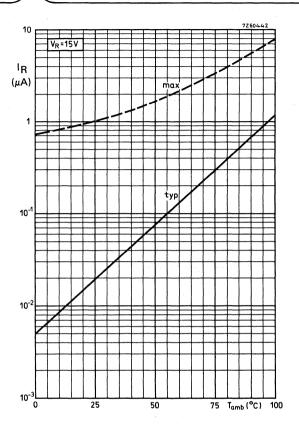


Fig. 4.

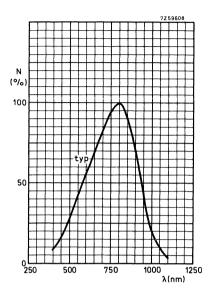


Fig. 5.

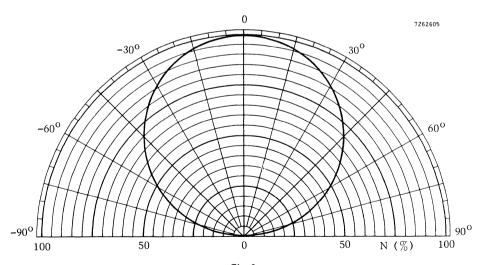


Fig. 6.

Unencapsulated photodiode for general purpose applications.

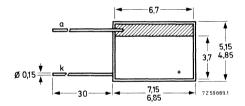
QUICK REFERENCE DATA

Reverse voltage	٧R	max.	12 V
Luminous current V _R = 10 V; E = 1000 lx	I _{Po}	typ.	110 μΑ
Dark reverse current at V _R = 10 V	I_R	<	5 μΑ
Wavelength at peak response	$\lambda_{\mathbf{p}}$	typ.	800 nm

MECHANICAL DATA

Fig. 1.

Dimensions in mm

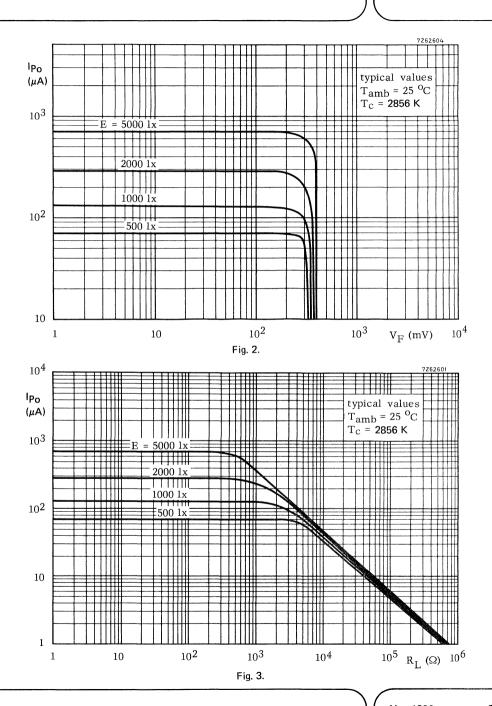


Slice thickness 0,27 mm

^{*} Sensitive area 6,7 x 3,7 mm.

RATINGS				
Limiting values in accordance with the Absolute Maximum S	System (IEC 134)			
Reverse voltage	v_R	max.	12	V .
Forward current	1 _F	max.	50	mA
Dark reverse current	۱ _R	max.	20	mA
Storage temperature	T_{stg}	-65 to	+ 125	oC
Junction temperature	T_{j}	max.	125	оС
THERMAL RESISTANCE				
From junction to ambient in free air	R _{th j-a}	=	0,3	K/mW
CHARACTERISTICS				
T _{amb} = 25 °C unless otherwise specified				
Dark reverse current		typ.	0,1	μА
V _R = 10 V	^I R	<	5,0	•
V _R = 10 V; T _{amb} = 100 °C	IR	typ.	6,0 40	μΑ μΑ
Photovoltaic mode $E = 1000 \text{ lx}$; $T_C = 2856 \text{ K (equivalent to 4,75 mW/cm}^2$)				
Light reverse current; V = 0	I ₁	> typ.	75 140	μΑ μΑ
Forward voltage; I = 0	V _F	> typ.	330 350	
Luminous current with external voltage*				
$V_R = 10 \text{ V}$; E = 1000 lx; $T_c = 2856 \text{ K}$ (equivalent to 4,75 mW/cm ²)	I _{Po}	> typ.	85 110	μΑ μΑ
Wavelength at peak response	λ_{p}	typ.	800	nm
Diode capacitance; f = 500 kHz				_
V _R = 10 V	C _d	typ.	1000	•
V _R = 0	C _d	typ.	3000	
Cut-off frequency (modulated GaAs source)	f _{co}	typ.	500	kHz

^{*} The value of light current increases with temperature by an amount approximately equal to the increase in dark current.



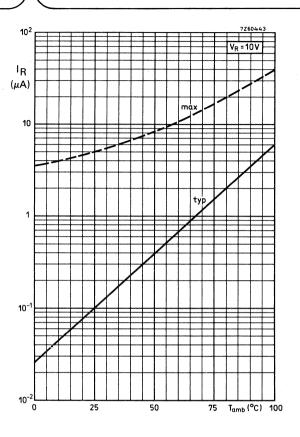


Fig. 4.

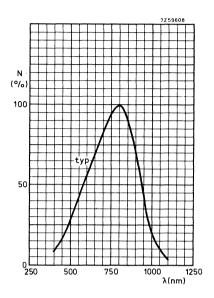


Fig. 5.

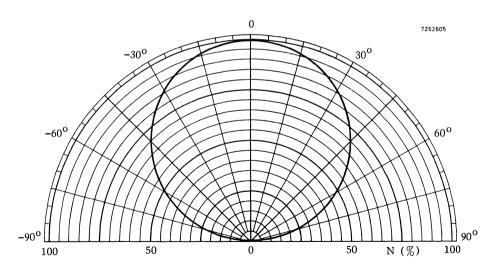


Fig. 6.



PIN silicon planar photodiode mounted in a SOT-49 envelope.

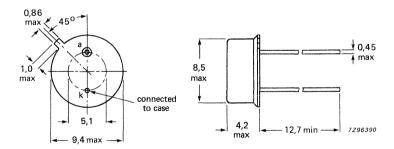
QUICK REFERENCE DATA

Reverse voltage	BPX61 BPX61P	VR	max. max.	32 V 70 V
Sensitivity $V_R = 5 V$; $E = 1 \text{ mW/cm}^2$; $\lambda = 930 \text{ nm}$		SF	min.	35 μΑ
Sensitive area		A	typ.	6,75 mm ²
Total power dissipation up to T _{amb} = 25 °C		P _{tot}	max.	325 mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-49/3.



BPX61 BPX61P

RATINGS						
Limiting values in accordance with the Absolute	e Maximu	m System (IE	C 134)			
Reverse voltage	-	BPX61 BPX61P	v_R	max. max.	32 70	V V *
Total power dissipation up to T _{amb} = 25 °C			P _{tot}	max.	325	mW
Storage temperature			T _{stq}	-65 to	+150	oC
Junction temperature			Τį	max.	125	оС
Operating temperature			Top	-40 to	+125	oC
THERMAL RESISTANCE						
Thermal resistance from junction to ambient			R _{th j-a}	max.	220	K/W
CHARACTERISTICS						
$T_j = 25$ °C unless otherwise stated						
Reverse voltage $I_R = 100 \mu A$		BPX61 BPX61P	VR	min. min.	32 70	
Dark current V _R = 10 V	1	BPX61	I _R	typ. max.	30	nA nA
	ı	BPX61P	IR	typ. max.	0,6 1	nA nA
Photovoltaic voltage (see note 1) E = 100 lux E = 1000 lux Light current (see note 1) V _R = 5 V; E = 1000 lux			V _L V _L	typ. typ.	285 365 70	
Light current $V_R = 5 V$; $E = 1 \text{ mW/cm}^2$ $\lambda = 930 \text{ nm}$			SE	min. typ.		μΑ μΑ
Wavelength at peak response V _R = 5 V			λр	typ.	850	nm
Capacitance V _R = 0 V			CJ0	typ.	70	pF
V _R = 3 V	1	BPX61	CJ3	typ. max.		pF pF
V _R = 50 V		BPX61P	CJ50	typ.		pF
Sensitive area			Α	typ.	6,75	$\mathrm{mm^2}$
Temperature coefficients			K _{VL} K _{IL}	typ. typ.		mV/ºC %/ºC
Switching times (see Figs 2 and 3) V $_R$ = 10 V; $_L$ = 1 k $_\Omega$; $_\lambda$ = 930 nm	PBX61,	BPX61P	t _r t _f	typ. typ.		ns ns
$V_R = 50 \text{ V}$; $R_L = 1 \text{ k}\Omega$; $\lambda = 930 \text{ nm}$	ı	BPX61P	t _r t _f	typ. typ.		ns ns
* At this voltage, the junction temperature mu	ust be lowe	er than 70 °C.		cyp.	20	

Noise	equivalent power
	10.17

BPX61	NEP	typ.	4,2 x 10 ^{-1 4}	$\frac{W}{\sqrt{Hz}}$
BPX61P	NEP	typ.	3 x 10 ^{-1 4}	$\frac{W}{\sqrt{Hz}}$
BPX61	D*	typ.	6,2 × 10 ^{-1 2}	$\frac{\text{cm}}{\text{W}} \frac{\sqrt{\text{Hz}}}{\text{W}}$
BPX61P	D*	min.	8,6 x 10 ^{-1 2}	cm $\sqrt{\text{Hz}}$

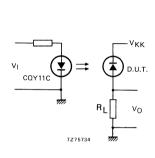


Fig. 2 Measuring circuit.

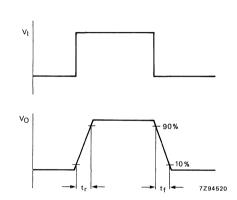


Fig. 3 Waveforms.

BPX61 BPX61P

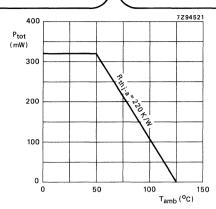


Fig. 4.

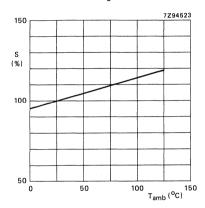


Fig. 6 $V_R = 5 V$; E = 1000 lux; typical values.

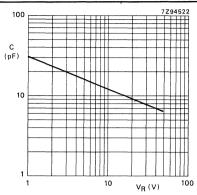


Fig. 5 f = 1 MHz; T_{amb} = 25 °C; typical values.

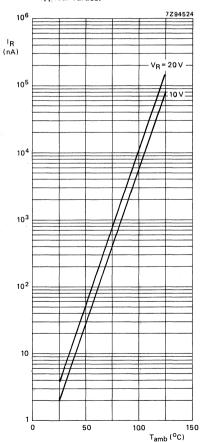


Fig. 7 E = 0; typical values BP \times 61.

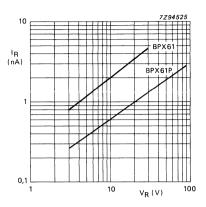


Fig. 8 $T_{amb} = 25$ °C; E = 0; typical values.

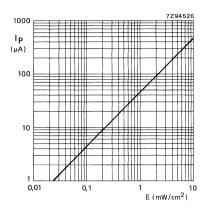


Fig. 9 V_R = 5 V; T_{amb} = 25 °C; λ = 930 nm; typical values.

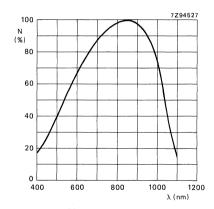


Fig. 10 Typical values.

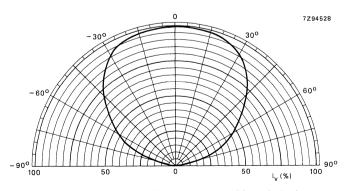


Fig. 11 $V_R = 5 V$; E = 1000 lux; $T_{amb} = 25 °C$; typical values.

Dimensions in mm

PHOTOTRANSISTOR

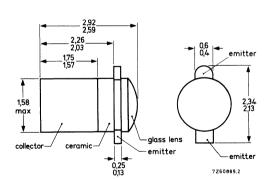
General purpose n-p-n silicon phototransistor with a glass lens. Inaccessable base.

QUICK REFERENCE DATA

Collector-emitter voltage		V _{CEO}	max.	50 V	-
ū			max.	20 mA	
Collector current (d.c.)		lC	max.		
Junction temperature		Тj	max.	150 °C	
Collector dark (cut-off) current $V_{CE} = 30 \text{ V}$		I _{CEO}	<	25 nA	
Collector light (cut-off) current $V_{CE} = 5 \text{ V}$; $E_e = 20 \text{ mW/cm}^2$	BPX71 BPX71-204	lp lp		to 15 mA to 15 mA	•
Wavelength at peak response		λ_{p}	typ.	800 nm	
Half sensitivity angle		θ1/2	typ.	40°	

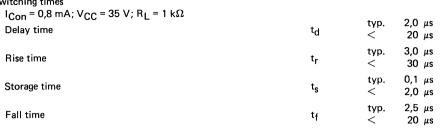
MECHANICAL DATA

Fig. 1 SOT-71A (DO-31).



RATINGS						
Limiting values in accordance with the Absolute Maxim	num System (IE	C 134)				
Collector-emitter voltage		V_{CEO}	max.	50	V	
Emitter-collector voltage		V _{ECO}	max.	7	V	
Collector current						
d.c.		l C	max.	20	mΑ	
(peak value); $t_p \le 50 \mu s$; $\delta \le 0.1$		ICM	max.	50	mΑ	
Total power dissipation						
up to T _{amb} = 50 °C		P_{tot}	max.		mW	
up to T _{mb} = 55 °C		P _{tot}	max.		mW	
Storage temperature		T_{stg}	-65 to	+ 150	οС	
Junction temperature		T_{j}	max.	150	oC	
THERMAL RESISTANCE						
From junction to ambient in free air		R _{th j-a}	= "	2000	K/W	
From junction to mounting base		R _{th j-mb}	=	950	K/W	
CHARACTERISTICS						
T _{amb} = 25 °C unless otherwise specified						
Collector dark (cut-off) current						
V _{CE} = 30 V		ICEO	<	25	nΑ	
$V_{CE} = 30 \text{ V; } T_{amb} = 100 ^{o}\text{C}$		ICEO	< '	100	μΑ	
Collector light current						
V _{CE} = 5 V; tungsten filament lamp						
source with colour temperature 2856 K E _e = 4,75 mW/cm ²		lр	typ.	1	mA	
$E_{\rm p} = 20 \text{mW/cm}^2$	BPX71	lp		to 15		
Le - 20 mw/cm	BPX71-204	lp		to 15		-
Collector-emitter breakdown voltage		•				
$E = 0$; $I_C = 0.5 \text{ mA}$		V _{(BR)CEO}	>	50	V	
Emitter-collector breakdown voltage						
$E = 0$; $I_C = 0.1 \text{ mA}$		V(BR)ECO	>	7	V	
Collector-emitter light saturation voltage			typ.	150	mV	
$I_{C} = 0.4 \text{ mA}$; $E_{e} = 20 \text{ mW/cm}^{2}$; $T_{c} = 2856 \text{ K}$		V _{CEsat}	<		mV	
Wavelength at peak response		λ_{p}	typ.	800	nm	
Bandwidth at half height		Δλ	typ.	400	nm	

Switching times



20 ns 20 μs 500 Hz

800 nm

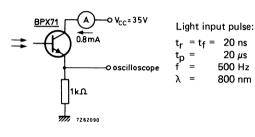


Fig. 2 Test circuit.

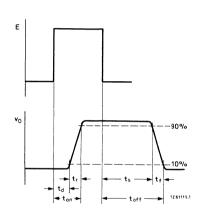


Fig. 3 Waveforms.

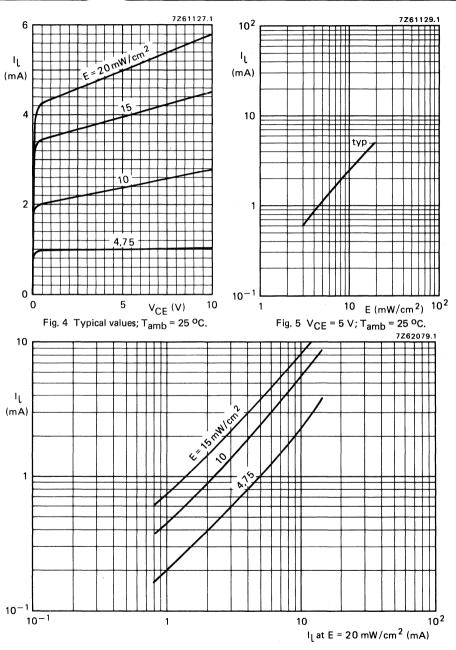


Fig. 6 $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^{o}\text{C}$; typical values.

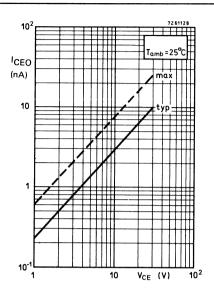


Fig. 7.

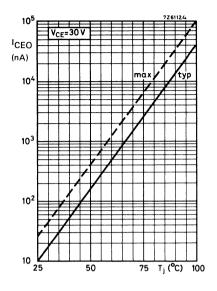


Fig. 8.

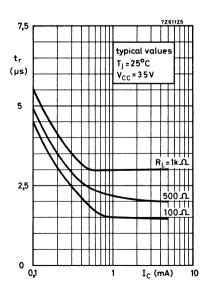


Fig. 9.

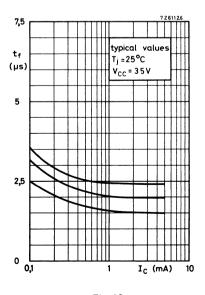


Fig. 10.

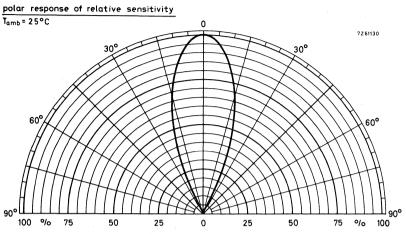


Fig. 11 Typical values.

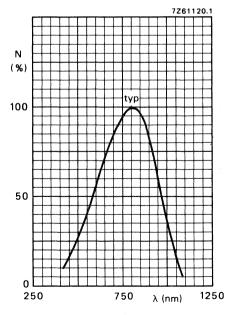


Fig. 12.

PHOTOTRANSISTOR

General purpose n-p-n silicon phototransistor with a plastic lens.

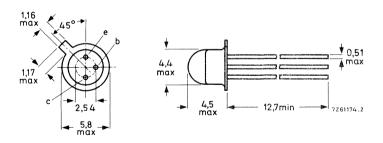
QUICK REFERENCE DATA

Collector-emitter voltage (open base)		v_{CEO}	max. 50 V
Collector current (d.c.)		Ic	max. 25 mA
Junction temperature		Τį	max. 125 °C
Collector dark (cut-off) current $V_{CE} = 20 \text{ V}$, ICEO	< 100 nA
Collector light (cut-off) current $V_{CE} = 5 \text{ V}$; $E_v = 1000 \text{ Ix } (E_e = 4,75 \text{ mW/cm}^2)$	BPX72 BPX72D BPX72E BPX72F	10 10 10	500 to 3000 μA 850 to 2000 μA 1400 to 3000 μA 2400 to 5000 μA
Wavelength at peak response		λ _p	typ. 800 nm
Half sensitivity angle		$\theta \frac{1}{2}$	typ. 120°

MECHANICAL DATA

Fig. 1 SOT-70A.

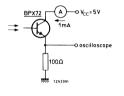
Dimensions in mm



Maximum lead diameter is guaranteed only for 12,7 mm.

RATINGS					
Limiting values in accordance with the Absolute Ma	ximum Syster	n (IEC 134)			
Collector-base voltage (open emitter)		V _{СВО}	max.	50	V
Collector-emitter voltage (open base)		V _{CEO}	max.	50	V
Emitter-collector voltage (open base)		V _{ECO}	max.	7	V
Collector current					
d.c.		C	max.		mΑ
(peak value); $t_p \le 50 \mu s$; $\delta \le 0,1$		ICM	max.		mΑ
Total power dissipation up to $T_{amb} = 25$ °C		P_{tot}	max.	180	mW
Storage temperature		T_{stg}	-40 to	+ 125	оС
Junction temperature		Тj	max.	125	oC.
THERMAL RESISTANCE					
From junction to ambient in free air		R _{th j-a}	=	550	K/W
CHARACTERISTICS					
$I_B = 0$; $T_{amb} = 25$ °C unless otherwise specified					
Collector dark (cut-off) current			typ.	10	nΑ
V _{CE} = 20 V		^I CEO	<	100	
V 20 V-T 100 00			typ.	10	μΑ
$V_{CE} = 20 \text{ V}; T_j = 100 ^{\circ}\text{C}$		ICEO	<	100	μΑ
Collector light (cut-off) current					
V _{CE} = 5 V; tungsten filament lamp source with colour temperature 2856 K					
$E_V = 1000 \text{ lx } (E_e = 4,75 \text{ mW/cm}^2)$	BPX72	lc	500 to	3000	μΑ
	BPX72D	IC	850 to		•
	BPX72E BPX72F	IC IC	1400 to 2400 to		•
$E_{V} = 2500 \text{ lx } (E_{e} = 12 \text{ mW/cm}^{2})$	DI 7(72)	lc	typ.	3000	•
Collector-base breakdown voltage		'C	typ.	3000	μΛ
E = 0; I _C = 0,1 mA		V _{(BR)CBO}	>	50	V
Collector-emitter breakdown voltage		(511,7050			
$E = 0; I_C = 1 \text{ mA}$		V(BR)CEO	>	50	٧
Emitter-collector breakdown voltage				_	
$E = 0$; $I_C = 0.1$ mA		V(BR)ECO	>	7	V
Collector capacitance $I_E = I_e = 0$; $V_{CB} = 20 \text{ V}$		C _c	typ.	3,5	pF
Wavelength at peak response		λ _p	typ.	800	
Bandwidth at half height		Λρ Δλ	typ.	400	
			-71-	.00	

Switching times I_{Con} = 1 mA; V_{CC} = 5 V; R_L = 100 Ω Delay time	^t d	typ.	3,0 μs 6,0 μs
Rise time	t _r		6,0 μs 20 μs
Storage time	t _s	typ.	1,5 μs 3,0 μs
Fall time	t _f	typ.	4,0 μs 20 μs



Light input pulse: $\begin{array}{lll} t_r &= t_f = & 20 \text{ ns} \\ t_p &= & 20 \ \mu\text{s} \\ f &= & 500 \ \text{Hz} \\ \lambda &= & 800 \ \text{nm} \end{array}$

Fig. 2 Test circuit.

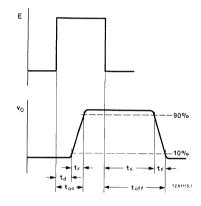


Fig. 3 Waveforms.

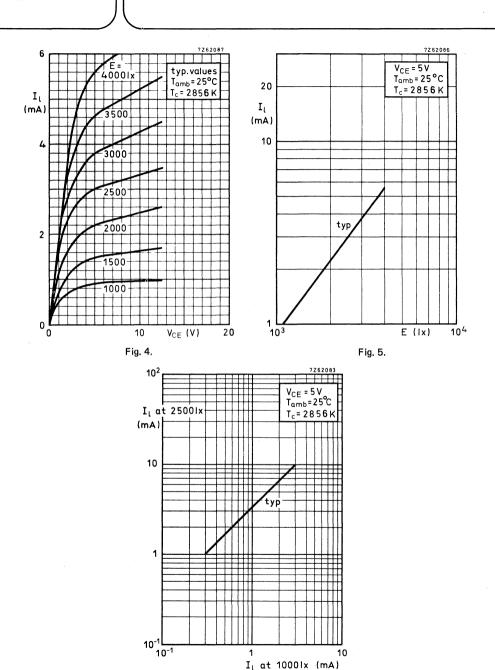


Fig. 6.

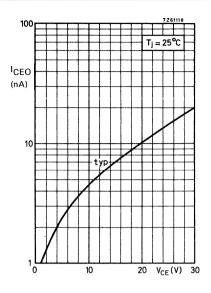


Fig. 7.

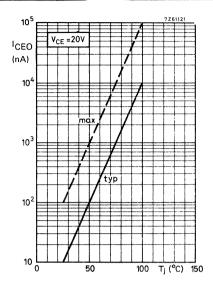


Fig. 8.

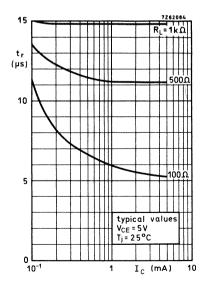


Fig. 9.

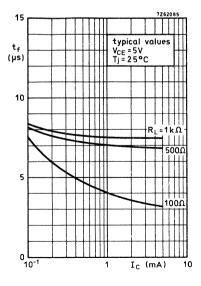


Fig. 10.

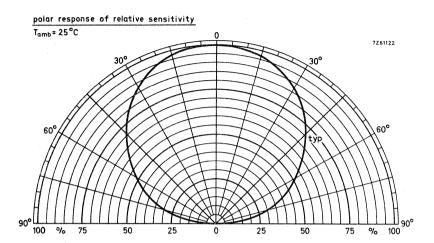
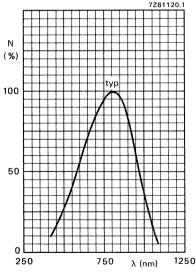


Fig. 11 Typical values.

100

 C_{c}

(pF)



10 typ 10 10 V_{CB}(V) 100

Fig. 12.

Fig. 13.

Tj = 25° C

SECTION B3

Infrared light emitting diodes



HIGH-SPEED INFRARED EMITTING DIODE

Circular infrared emitting diode with diameter of 5 mm which emits infrared light at a typical peak wavelength of 830 nm (GaAlAs; infrared) when forward biased.

The CQW89A has a SOD-63 outline and is moulded in a light blue encapsulation with long leads.

The application of new GaAlAs (intrinsic) technology results in extremely short switching times and very low degradation during the devices operating life.

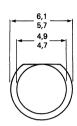
It is intended for remote control applications using carrier frequencies up to 1 MHz. Combination with the high-speed photo p-i-n diode BPW50 is recommended.

QUICK REFERENCE DATA

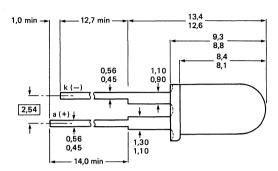
Continuous reverse voltage		VR	max.	5	V
Forward current (d.c.)		۱F	max.	130	mΑ
Total power dissipation up to T _{amb} = 25 °C		Ptot	max.	300	mW
Junction temperature		Тj	max.	100	oC
Radiant intensity (on axis) static (at d.c. condition)		· ·			
IF = 100 mA	CQW89A	Ιe	min.	9	mW/sr
	CQW89A-1	Ιe	min.	12	mW/sr
	CQW89A-2	Ιe	min.	15	mW/sr
dynamic (at pulse condition) $I_{FM} = 100 \text{ mA}$; $t_p = 0.5 \mu s$; $\delta = 0.5$		l _{eD}	typ.	0,8	le
Switching times (see Figs 2 and 3) IF = 100 mA		t _r	typ.	30	ns
1F 100 III/A		tf	typ.	30	ns
Wavelength at peak emission		λ_{p}	typ.	830	nm
Beamwidth at half-intensity directions		$\theta \frac{1}{2}$	typ.	40	0

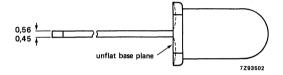
MECHANICAL DATA

Fig. 1 SOD-63D2.



Dimensions in mm





RATINGS					
Limiting values in accordance with the Absolute Max	imum System (I	EC 134)			
Continuous reverse voltage		v_R	max.	5	V
Forward current d.c.		lF	max.	130	mA
peak value; $t_p = 10 \mu s$; $\delta = 0.01$ peak value; $t_p = 50 \mu s$; $\delta = 0.01$		IFM IFM	max. max.	2500 1500	
Total power dissipation up to T _{amb} = 25 °C with heatsink		P _{tot}	max.	300	mW
Storage temperature		T _{stg}	–55 to	+100	оC
Junction temperature		T _i	max.	100	
Lead soldering temperature		J			
t_{sld} < 10 s		T_{sld}	max.	260	oC
THERMAL RESISTANCE					
From junction to ambient when the device is mounted on a printed circuit be	pard	R _{th j-a}	max.	350	K/W
CHARACTERISTICS					
T _j = 25 °C unless otherwise specified					
Forward voltage $I_F = 1.5 \text{ A}; t_{On} = 50 \mu \text{s}; \delta = 0.01$		۷F	typ.	3,7	V
Forward voltage			typ.	1,7	V
I _F = 100 mA		٧F	max.	2,2	
Reverse current V _R = 5 V		I _R	max.	100	μА
Diode capacitance at f = 1 MHz		.11			
V _R = 0		c_d	typ.	200	pF
Total radiant power IF = 100 mA		$\phi_{ extsf{e}}$	typ.	8	mW
Radiant intensity (on axis) static (at d.c. condition)					
IF = 100 mA	CQW89A CQW89A-1	le	min. min.		mW/sr mW/sr
	CQW89A-2	l _e l _e	min. min.		mW/sr
dynamic (at pulse condition)* $I_{FM} = 100 \text{ mA; } t_D = 0.5 \mu \text{s; } \delta = 0.5$		l- n	tvn	0,8	l_
τ _{ΕΙΝΙ} – του πιΑ, τ _D – υ,ο με, υ – υ,ο		leD	typ.	0,0	'e

^{*} I_{eD} = Dynamic radiant intensity (average radiant intensity level during pulse time).

Radiant power temperature coefficient
Wavelength at peak emission IF = 100 mA
Bandwidth at half-height $I_F = 100 \text{ mA}$
Beamwidth at half-intensity direction I _F = 100 mA
Switching times (see Figs 2 and 3) IF = 100 mA

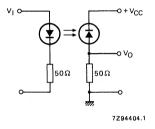


Fig. 2 Measuring circuit.

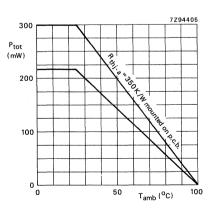
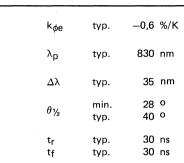


Fig. 4 Typical values.



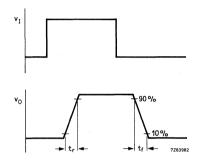


Fig. 3 Waveforms.

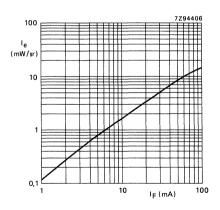


Fig. 5 t_{on} = 10 μ s; δ = 0,01; T_{amb} = 25 °C; typical values.

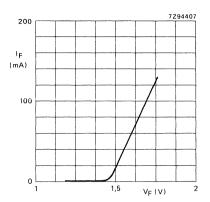


Fig. 6 T_{amb} = 25 °C; typical values.

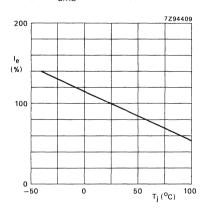


Fig. 8 IF = 100 mA; typical values.

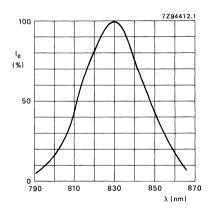


Fig. 10 Spectral response; typical values.

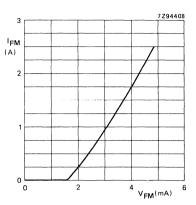


Fig. 7 $t_{on} = 10 \mu s$; $T_{amb} = 25 \, {}^{o}C$; typical values.

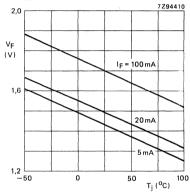


Fig. 9 Typical values.

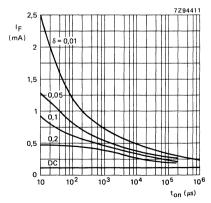


Fig. 11 Typical values.

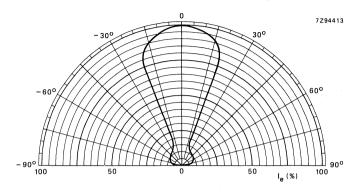


Fig. 12 Typical values.

GaAs LIGHT EMITTING DIODE

Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. The diode is provided with a flat glass window.

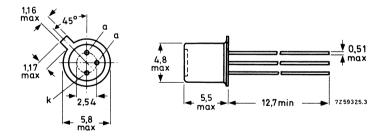
QUICK REFERENCE DATA

Continuous reverse voltage	V _R	max.	2 V
Forward current (d.c.)	I _F	max.	30 mA
Forward current (peak value) $t_D = 100 \ \mu s; \ \delta = 0,1$	FRM	max.	200 mA
Total power dissipation up to T _{amb} = 95 °C	P _{tot}	max.	50 mW
Total radiant power at IF = 20 mA	$\phi_{\mathbf{e}}$	> typ.	60 μW 100 μW
Radiant intensity (on-axis) at IF = 20 mA	l _e	typ.	64 μW/sr
Light rise time at IFon = 20 mA	t _r	<	100 ns
Light fall time at IFon = 20 mA	tf	<	100 ns
Wavelength at peak emission	λ_{p}	typ.	880 nm
Thermal resistance from junction to ambient	R _{th j-a}	=	0,6 K/mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-18, except for window.



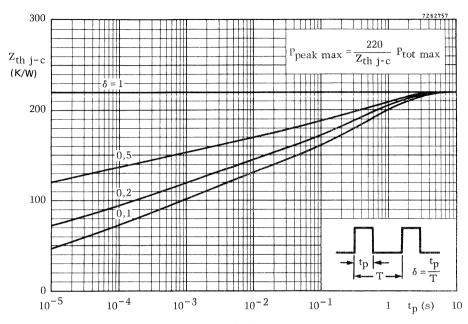
Max. lead diameter is guaranteed only for 12,7 mm.

CQY11B

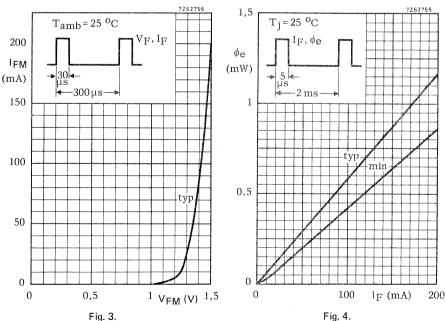
RATINGS

RATINGS				
Limiting values in accordance with the Absolute Maximum S	ystem (IEC 134	1)		
Continuous reverse voltage	V_{R}	max.	2	V
Forward current (d.c.)	IF	max.	30	mA
Forward current (peak value) $t_p = 100 \ \mu s; \ \delta = 0.1$	IFRM	max.	200	mA
Total power dissipation up to T _{amb} = 95 °C	P _{tot}	max.	50	mW
Storage temperature	T _{stg}	-55 to	+150	oC
Operating junction temperature	Tj	max.	125	oC
THERMAL RESISTANCE				
From junction to ambient in free air	R _{th j-a}	=	0,6	K/mW
From junction to case	R _{th j-c}	==	0,22	K/mW
CHARACTERISTICS				
T _{amb} = 25 °C unless otherwise specified				
Forward voltage at I _F = 30 mA	VF	typ.	1,3 1,6	
I _{FM} = 0,2 A	VF	typ.	1,5	V
Reverse current at V _R = 2 V	IR	<	100	μΑ
Diode capacitance at $f = 1 \text{ MHz}$; $V_R = 0$	Cd	typ.	65	pF
Radiant output power at IF = 20 mA	ϕ_{e}	> typ.	60 100	μW μW
$I_F = 20 \text{ mA}; T_j = 100 {}^{\circ}\text{C}$	$\phi_{\mathbf{e}}$	typ.	50	μW
I _F = 200 mA *	ϕ_{e}	typ.	1,16	mW
Radiant intensity (on-axis) at $I_F = 20 \text{ mA}$	l _e	typ.	64	μW/sr
Radiance at I _F = 20 mA	Le	typ.	1,6	mW/mm² sr
IF = 200 mA *	Le	typ.	15	mW/mm ² sr
Emissive area	Ae	typ.	0,04	mm ²
Wavelength at peak emission	λ_p	typ.	880	nm
Bandwidth at half height	Δλ	typ.	40	nm
Switching times			00	
Rise time at IFon = 20 mA	t _r	typ.	100	ns ns
Fall time at I _{Fon} = 20 mA	tf	typ.	30 100	ns ns

^{*} $t_p = 100 \,\mu s$; $\delta = 0.1$.







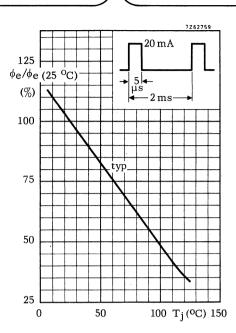


Fig. 5.

Fig. 6.

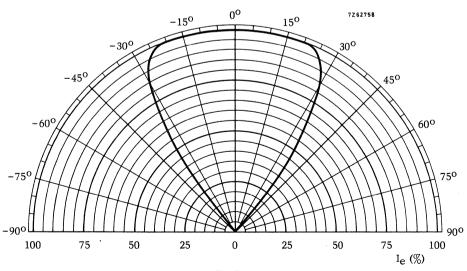


Fig. 7.

GaAs LIGHT EMITTING DIODE

Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Suitable for combination with phototransistor BPX25 or BPX72.

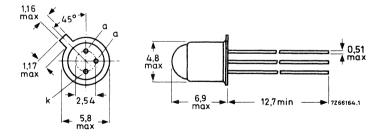
QUICK REFERENCE DATA

Continuous reverse voltage	V _R	max.	2 V
Forward current (d.c.)	le I	max.	30 mA
Forward current (peak value)	!FRM	max.	200 mA
Total power dissipation up to T _{amb} = 95 °C	P _{tot}	max.	50 mW
Total radiant power at I _F = 20 mA	$\phi_{ extsf{e}}$	typ.	50 μW
Radiant intensity (on-axis) at IF = 20 mA	۱ _e	typ.	1,25 mW/sr
Light rise time at IFon = 20 mA	t _r	<	100 ns
Light fall time at IFon = 20 mA	tf	<	100 ns
Wavelength at peak emission	$\lambda_{\mathbf{p}}$	typ.	880 nm
Thermal resistance from junction to ambient	R _{th j-a}	=	0,6 K/mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-18, except for lens.



RATINGS

Limiting values in accordance with the Absolute Maximum Syste	m (IEC 134)			
Continuous reverse voltage	VR	max.	2	V
Forward current (d.c.)	l _F	max.	30	mA
Forward current (peak value)				
$t_p = 100 \ \mu s; \ \delta = 0,1$	FRM	max.	200	mA
Total power dissipation up to T _{amb} = 95 °C	P _{tot}	max.	50	mW
Storage temperature	T_{stg}	55 to	+150	oC
Junction temperature	Tj	max.	125	oC
THERMAL RESISTANCE				
From junction to ambient in free air	R _{th j-a}	=	0,6	K/mW
From junction to case	R _{th j-c}	==	0,22	K/mW
CHARACTERISTICS				
T _{amb} = 25 °C unless otherwise specified				
Forward voltage at I _F = 30 mA	VF	typ.	1,3 1,6	
I _{FM} = 200 mA	VF	typ.	1,5	
Reverse current at V _R = 2 V	I _R	<	100	μA
Diode capacitance at V _R = 0; f = 20 MHz	Cd	typ.		, pF
Total radiant power at IF = 20 mA	$\phi_{ m e}$	typ.		μW
Radiant intensity (on-axis) at IF = 20 mA	le	typ.		mW/sr
Mean irradiance on a receiving area with D = 2 mm	· C	+1 F*	. ,0	
at a distance a = 10 mm and at I _F = 20 mA,			0.00	141/ 7
measured as in Fig. 2	Ee	> typ.	-,	mW/cm ² mW/cm ² *
		cyp.	5,50	11144/0111

^{*} This corresponds typically with IE = 0,4 mA in a phototransistor BPX25 and with 200 μ A in a phototransistor BPX72.

CHARACTERISTICS (continued) Decrease of radiant power with temperature	$rac{\Delta\phi_{\mathbf{e}}}{\DeltaT_{j}}$	typ.	0,7 %/K
Cross-section of the radiant beam between 0 to 10 mm from the lens	A _{beam}	typ.	7 mm²
Angle between optical and mechanical axis		typ.	6 °
Wavelength at peak emission	λ_{p}	typ.	880 nm
Bandwidth at half height	$\theta_{1/2}$	typ.	40 nm
Switching times Rise time at IFon = 20 mA	t _r	typ.	30 ns 100 ns
Fall time at I Fon = 20 mA	tf	typ.	30 ns 100 ns

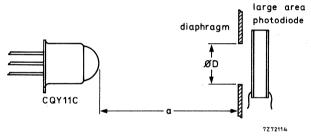


Fig. 2.

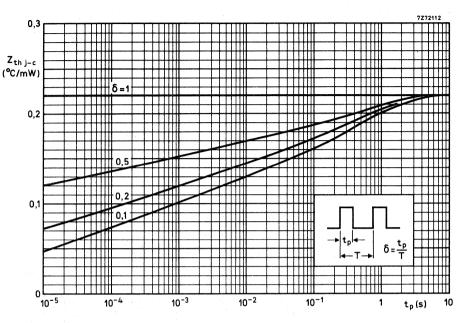
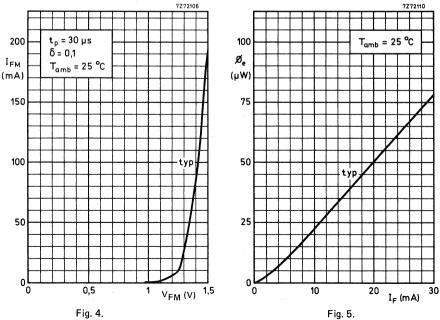
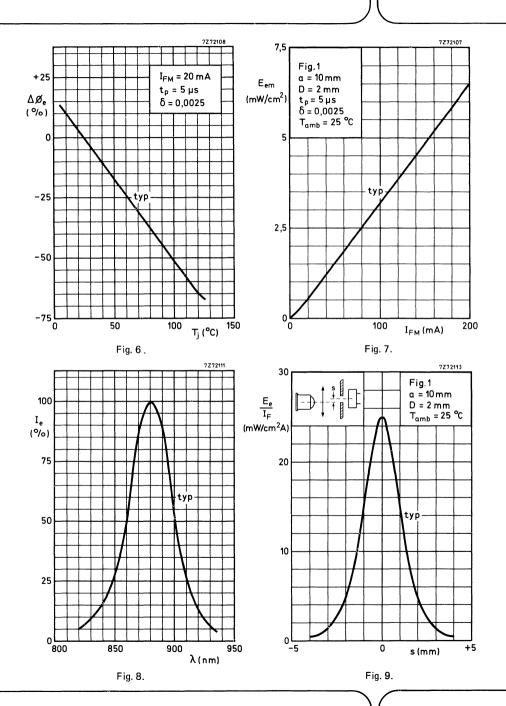


Fig. 3.





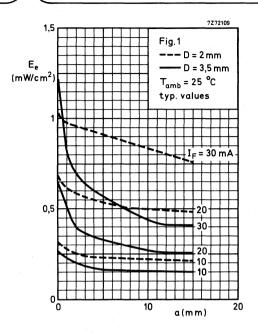
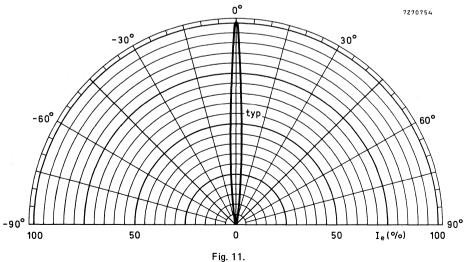


Fig. 10.



GaAs LIGHT EMITTING DIODES

Epitaxial gallium arsenide light emitting diodes intended for optical coupling and encoding. They emit radiation in the near infrared when forward biased. Envelopes like TO-18. Suitable for combination with phototransistors BPX25 and BPX72.

QUICK REFERENCE DATA

Continuous reverse voltage		٧R	max.	5	٧
Forward current (d.c.)		۱F	max.	100	mΑ
Total power dissipation up to T _{amb} = 25 °C		P_{tot}	max.	150	mW
Radiant intensity (on-axis) at IF = 50 mA	CQY49B CQY49C	l _e l _e	max. max.		mW/sr mW/sr
Wavelength at peak emission		λ_{p}	typ.	930	nm
Thermal resistance from junction to ambient		R _{th j-a}	=	0,665	K/mW

MECHANICAL DATA

Dimensions in mm

Fig. 1 CQY49B: TO-18 except for window.

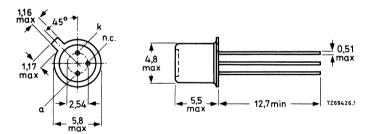
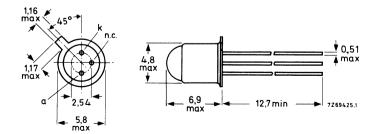


Fig. 1b CQY49C: TO-18 except for lens.



RATINGS								
Limiting values in accordance with the Absolute Maximum System (IEC 134)								
Continuous reverse voltage	v_R	max.	5 V					
Forward current (d.c.)	l F	max.	100 mA					
Forward current (peak value) $t_D < 10 \ \mu s$; $\delta < 0.01$	FRM	max.	1 A					
Total power dissipation up to T _{amb} = 25 °C	P _{tot}	max.	150 mW					
Storage temperature	T _{stg}		-55 to +100 °C					
Operating junction temperature	Τį	max.	125 °C					
Lead soldering temperature $>$ 1,5 mm from the body; $t_{sld} <$ 10 s	T _{sld}	max.	260 °C					
THERMAL RESISTANCE								
From junction to ambient in free air	R _{th i-a}	=	0,665 K/mW					
From junction to case	R _{th j-c}	·. =	0,3 K/mW					
CHARACTERISTICS								
T _j = 25 °C unless otherwise specified								
			CQY49B CQY49C					
Forward voltage at IF = 50 mA	VF	typ. max.	1,3 V 1,5 V					
Reverse current at V _R = 5 V	۱R	max.	100 μΑ					
Diode capacitance								
$V_R = 0$; $f = 1 MHz$	C_d	typ.	55 pF					
Radiant intensity (on-axis) at $I_F = 50 \text{ mA}$	le	min. typ.	0,3 3 mW/sr 0,5 5 mW/sr					
Wavelength at peak emission	$\lambda_{\mathbf{p}}$	typ.	930 nm					
Bandwidth at half height	$\Delta \lambda$	typ.	50 nm					
Beamwidth between half-intensity directions	$\theta_{1/2}$	typ.	800 150					
Switching times $I_{Fon} = 50 \text{ mA; } t_p = 2 \mu \text{s; } f = 45 \text{ kHz}$			•					
Rise time	tr	typ.	600 ns					

tf

typ.

350

ns

Fall time

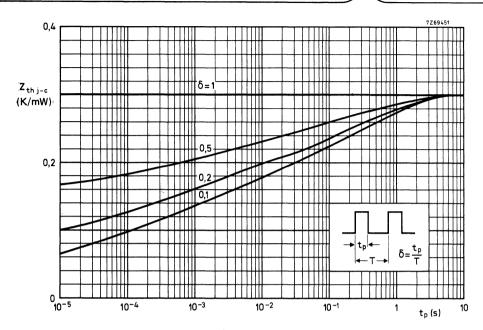
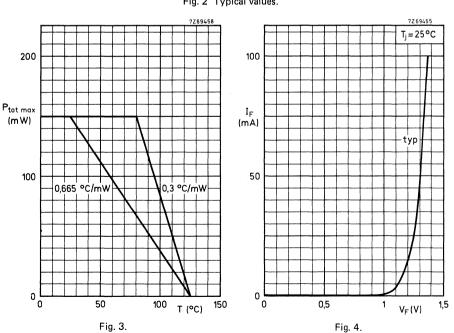
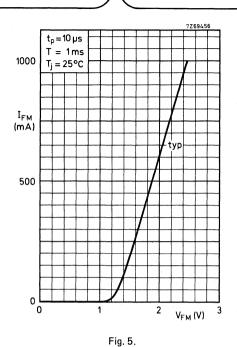
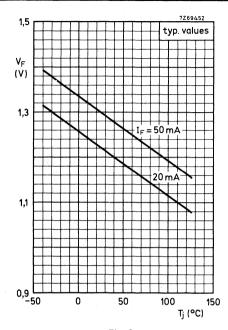


Fig. 2 Typical values.







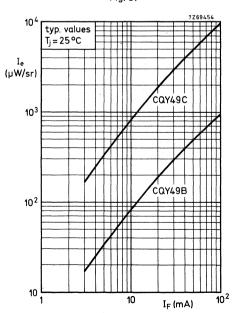
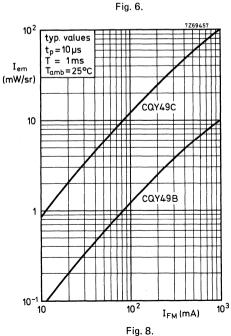
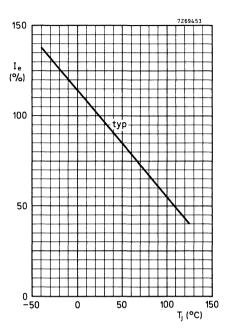


Fig. 7.





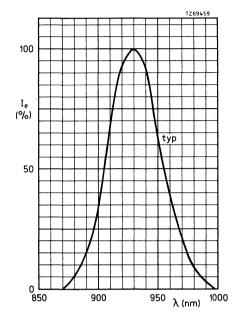


Fig. 9.



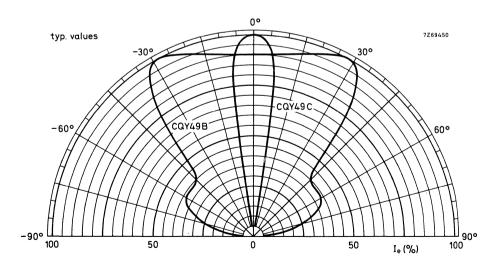


Fig. 11.



GaAs LIGHT EMITTING DIODF

Gallium arsenide light emitting diodes which emit near-infrared light when forward biased. Ceramic-metal envelope with glass lens like BPX71, suitable for matrix layout on printed circuit boards. In conjunction with BPX71 also suitable for punched card reading.

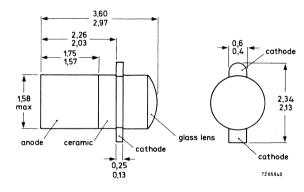
QUICK REFERENCE DATA

Continuous reverse voltage	٧R	max.		2	V
Forward current (d.c.)	1F	max.	10	00	mA
Total power dissipation up to T _{amb} = 25 °C mounted on printed circuit board	P _{tot}	max.	15	50	mW
			CQY50	CQY5	2
Total radiant power at IF = 20 mA	ϕ_{e}	>	160	400	μW
Radiant intensity (on-axis) at IF = 20 mA	Ιe	>	180	450	μW/sr
Wavelength at peak emission	λ_{p}	typ.	93	80	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-31, except for length.



CQY50 CQY52

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134) 2 V Continuous reverse voltage V_{R} max. Forward current (d.c.) ۱F max. 100 mΑ Forward current (peak value) $t_D = 10 \ \mu s; \ \delta = 0.01$ 500 mΑ **IFRM** max. -65 to +150 oC Storage temperature Tstq Operating junction temperature 125 oC

Total power dissipation up to Tamb = 25 °C device mounted on printed circuit board * P_{tot} 150 mW max.

 T_i

max.

COVED COVES

THERMAL RESISTANCE

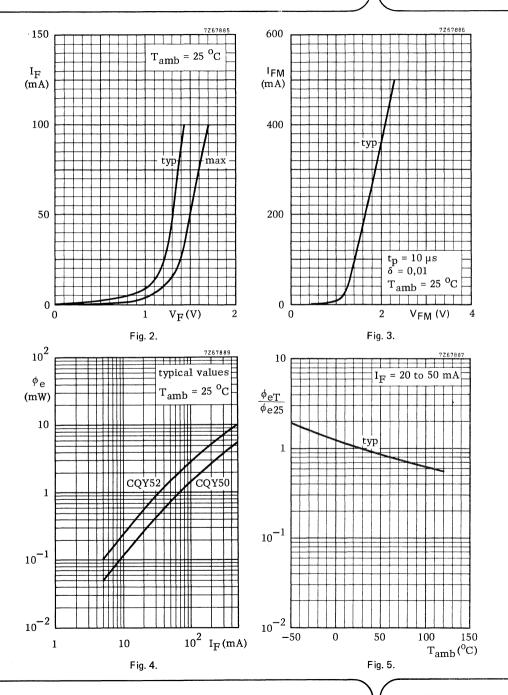
From junction to ambient, device mounted on printed circuit board * Rth j-a 0.66 K/mW

CHARACTERISTICS

Tamb = 25 °C unless otherwise specified

			COY50	CUY52
Forward voltage I _F = 50 mA	VF	typ.	1,3 1,5	1,3 V 1,5 V
IF = 500 mA; t_p = 10 μ s; δ = 0,01	VF	typ.	2,3	2,3 V
Reverse current at V _R = 2 V	IR	<	100	100 μΑ
Diode capacitance at $V_R = 0$; $f = 1 MHz$	Cd	typ.	45	45 pF
Total radiant power IF = 20 mA IF = 50 mA Radiant intensity (on-axis) at IF = 20 mA Wavelength at peak emission Bandwidth at half height	φe φe Ιe λρ Δλ	<pre>> typ. > typ. typ. typ.</pre>	160 700 180 930 40	400 μW 1500 μW 450 μW/sr 930 nm 40 nm
Beamwidth between half-intensity direction	ons $\theta_{\frac{1}{2}}$	typ.	350	350
Switching times $I_{Fon} = 20 \text{ mA}$; $t_p = 2 \mu s$; $f = 45 \text{ kHz}$				
Rise time	tr	typ.	600	600 ns
Fall time	t _f	typ.	350	350 ns

^{*} With copper islands of 6 x 2 mm on both sides of 1,6 mm glass-epoxy printed circuit board; thickness of copper 35 μ m.



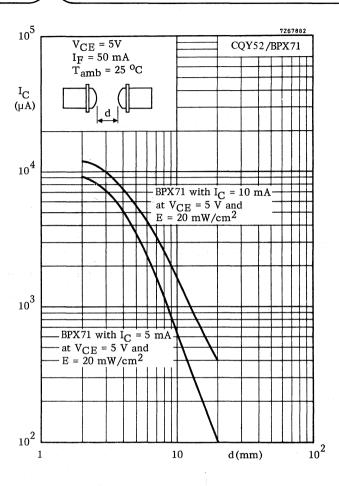


Fig. 6 Typical values.

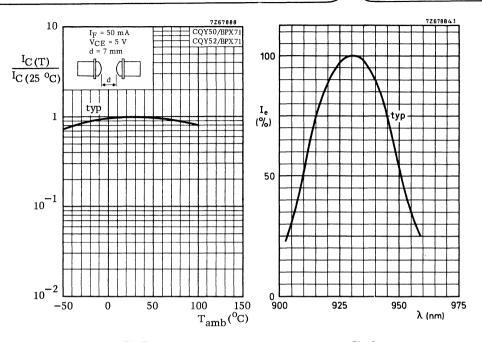


Fig. 7.

Fig. 8.

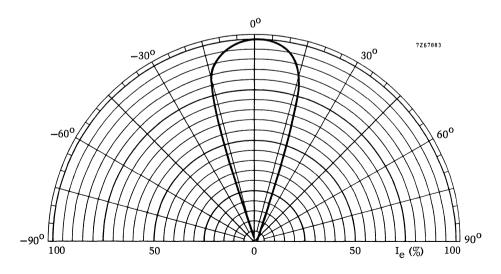


Fig. 9 Typical values.



DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 6 mm which emits visible red light at a maximum peak wavelength of 690 nm (GaPAs; red) when forward biased.

The CQY53S has an FO-81 outline with a clear plastic lens.

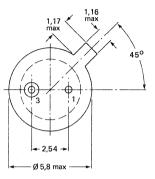
QUICK REFERENCE DATA

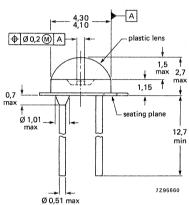
Continuous reverse voltage	v_R	max.	3 '	V
Forward current (d.c.)	IF	max.	50 r	mΑ
Total power dissipation up to T _{amb} = 45 °C	P_{tot}	max.	125 1	mW
Junction temperature	T_{j}	max.	85 ⁽	оС
Luminous intensity $I_F = 10 \text{ mA}$	I _V	min.	400 /	μcd
Wavelength at peak emission	λ_{p}	max.	690 r	nm
Beamwidth at half-intensity directions	$\theta_{1/2}$	min.	90 (0

MECHANICAL DATA

Fig. 1 FO-81.





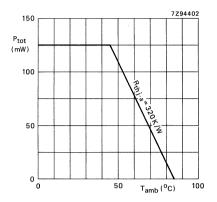


1: anode

3 : cathode (connected to case)

RATINGS

Limiting values in accordance with the Absolute Maximum System (II	EC 134)			
Continuous reverse voltage	v_R	max.	3	٧
Forward current (d.c.)	ΙF	max.	50	mA
Total power dissipation up to T _{amb} = 45 °C	P _{tot}	max.	125	mW
Storage temperature	T _{stg}	-40 t	o +100	оС
Junction temperature	Тj	max.	85	oC
Lead soldering temperature $t_{sld} \! < \! 7 \text{s}$	T _{sld}	max.	260	oC
THERMAL RESISTANCE				
From junction to ambient	R _{th j-a}	max.	320	K/W
CHARACTERISTICS				
T _j = 25 °C unless otherwise specified				
Forward voltage IF = 10 mA	VF	min. typ.	1,4 1,8	
Reverse current				
V _R = 3 V	۱R	max.	100	μΑ
Luminous intensity IF = 10 mA	I _V	min. max.	400 1000	•
Wavelength at peak emission	$\lambda_{\mathbf{p}}$	min. max.	630 690	
Bandwidth at half height	Δλ	typ. max.		nm nm
Beamwidth at half-intensity directions	$\theta 1/2$	min.	90	0



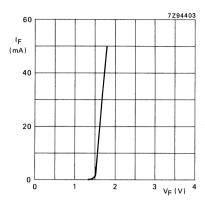


Fig. 2.

Fig. 3 Typical values.

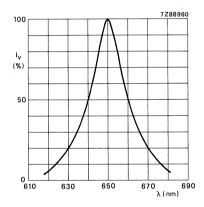


Fig. 4 Typical values.

Dimensions in mm

INFRARED EMITTING DIODE

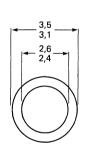
Diffused planar light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue). Combination with phototransistor BPW22A is recommended.

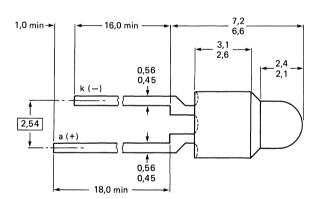
QUICK REFERENCE DATA

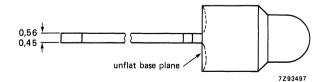
Continuous reverse voltage	v_R	max.	5 \	/
Forward current (d.c.)	۱F	max.	50 n	nΑ
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	100 n	nW
Radiant intensity (on-axis) at IF = 20 mA	le	typ.	2 n	nW/sr
Wavelength at peak emission	λ_{p}	typ.	930 n	ım
Beamwidth between half-intensity directions	$\theta_{1/2}$	typ.	20 °)

MECHANICAL DATA

Fig. 1 SOD-53F.







_	•	_			_
R	Δ	T	ır	JG	×

From junction to ambient,

device mounted on a printed-circuit board

Limiting values in accordance with the Absolute Maximum Sy	/stem (IEC 134)			
Continuous reverse voltage	· V _R	max.	5 V	
Forward current				
d.c.	lF	max.	50 mA	
(peak value); $t_p = 10 \ \mu s$; $\delta = 0.01$	FRM	max.	200 mA	
Total power dissipation up to $T_{amb} = 25$ °C (see Fig. 2)	P _{tot}	max.	100 mW	
Storage temperature	T _{stg}	-55 to	+ 100 °C	
Junction temperature	T _i	max.	100 °C	
Lead soldering temperature	-			
\rightarrow 1,5 mm from the seating plane; t_{sld} < 7 s	T _{sld}	max.	260 °C	
THERMAL RESISTANCE				

750 K/W

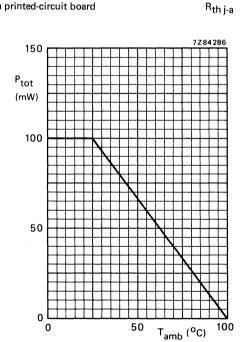


Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS		
T _j = 25 °C		
Forward voltage IF = 20 mA VF	typ. max.	1,2 V 1,5 V
Reverse current		
V _R = 5 V	max.	100 μΑ
Diode capacitance		
$V_R = 0$; $f = 1 MHz$	typ.	40 pF
Total radiant power	typ.	1 mW
$I_F = 20 \text{ mA}$ CQY58A $\frac{\Psi e}{I_e}$	min.	2 mW/sr
Radiant intensity (on-axis)		
I _F = 20 mA CQY58A-1 I _e	min.	1 mW/sr
	max.	5 mW/sr
CQY58A-2	min.	3 mW/sr
Wavelength at peak emission λ_p	typ.	930 nm
Bandwidth at half height $\Delta\lambda$	typ.	50 nm
Beamwidth between half-intensity directions		
$I_F = 20 \text{ mA}$ $\theta \gamma_2$	typ.	20 °
Switching times		
I _{Fon} = 20 mA		
Light rise time t _r	typ.	3 μs
Light fall time t _f	typ.	3 μs

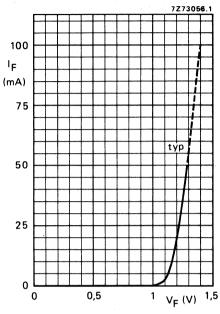


Fig. 3 $T_{amb} = 25$ °C.

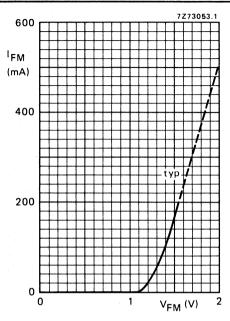


Fig. 4 t_p = 10 μ s; T = 1 ms; T_{amb} = 25 °C.

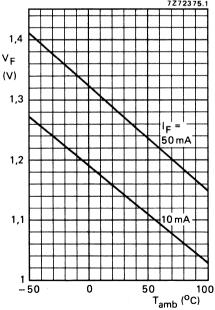
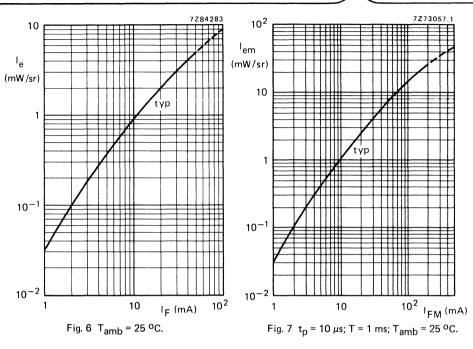


Fig. 5 Typical values.



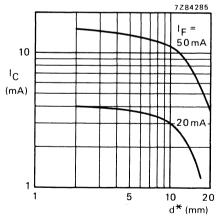


Fig. 8 $V_{CE} = 5 V$; $T_{amb} = 25 °C$; typical values.

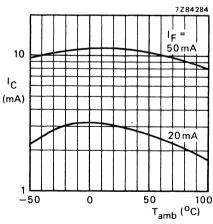


Fig. 9 V_{CE} = 5 V; d^* = 10 mm; typical values.

^{*} d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

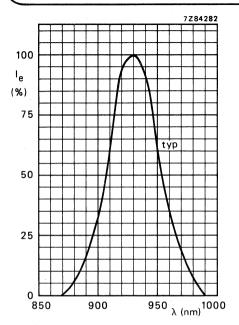


Fig. 10 Spectral response.

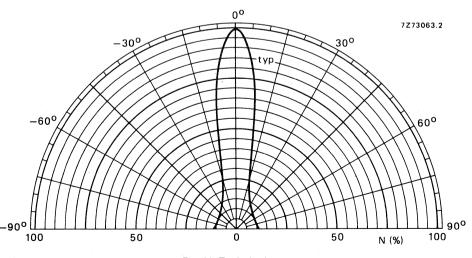


Fig. 11 Typical values.

GaAs LIGHT EMITTING DIODE

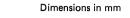
Epitaxial gallium arsenide light emitting diode intended for remote-control applications. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue). Combination with the photo p-i-n diode BPW50 is recommended.

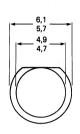
QUICK REFERENCE DATA

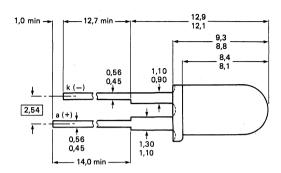
Continuous reverse voltage		VR	max.	5 '	V
Forward current (d.c.)		ΙF	max.	130 ו	mΑ
Total power dissipation up to T _{amb} = 25 °C		P_{tot}	max.	215 ו	mW
Junction temperature		Τj	max.	100	оС
Radiant intensity (on-axis) static (at d.c. condition) IF = 100 mA	CQY89A CQY89A-1 CQY89A-2	le le le	min. min. min.	12	mW/sr mW/sr mW/sr
dynamic (at pulse condition) IFM = 100 mA; t_p = 0,5 μ s; δ = 0,5 Wavelength at peak emission		l _{eD}	typ.	0,3 930 i	•

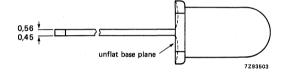
→ MECHANICAL DATA

Fig. 1 SOD-63B2.









RATINGS					
Limiting values in accordance with the Absolute Ma	ximum System	(IEC 134)			
Continuous reverse voltage		v_R	max.	5	V
Forward current (d.c.)		۱Ę	max.	130	mA
Forward current (peak value) $t_p \le 50 \ \mu s; \ \delta = 0.05$		¹ FM	max.	1000	mA
Non-repetitive peak forward current ($t_p \le 10 \mu s$)		^I FSM	max.	2500	mA
Total power dissipation up to T _{amb} = 25 °C		P_{tot}	max.	215	mW
Storage temperature		T_{stg}	-55 to	+ 100	oC
Junction temperature		Tj	max.	100	oC
Lead soldering temperature up to the seating plane; $t_{sld} < 10 \text{ s}$		T _{sld}	max.	260	оС
THERMAL RESISTANCE					
From junction to ambient mounted on a printed-circuit board		R _{th j-a}	=	350	K/W
CHARACTERISTICS					
T _i = 25 °C unless otherwise specified					
Forward voltage I _F = 100 mA		٧ _F	typ.	1,4 1,6	
I_{FM} = 1500 mA; t_D = 20 μ s; δ = 0,033		V_{FM}	typ.	2,4	V
Reverse current V _R = 5 V		ı _R	<	100	μΑ
Diode capacitance V _R = 0; f = 1 MHz		C _d	typ.	40	pF
Total radiant power		oa	typ.		
I _F = 100 mA		$\phi_{\mathbf{e}}$	>		mW mW
Decrease of radiant power with temperature			typ.	12	11111
I _F = 100 mA		$\frac{\Delta\phi_{e}}{\DeltaT_{j}}$	typ.	1	%/K
Radiant intensity (on-axis) static (at d.c. condition)					
I _F = 100 mA	CQY89A CQY89A-1	le	min. min.		mW/sr mW/sr
	CQY89A-1	l _e I _e	min. min.		mW/sr
dynamic (at pulse condition)*		C			•
$I_{FM} = 100 \text{ mA}$; $t_p = 0.5 \mu s$; $\delta = 0.5$		leD	typ.	0,3	le

^{*} leD = Dynamic radiant intensity (average radiant intensity level during pulse time).

Wavelength at peak emission $I_F = 100 \text{ mA}$	λ_{p}	typ.	930 nm
Bandwidth at half height $I_F = 100 \text{ mA}$	$\Delta \lambda$	typ.	50 nm
Beamwidth between half-intensity directions $I_F = 100 \text{ mA}$	$ heta_{1\!/_{\!2}}$	typ.	40 0

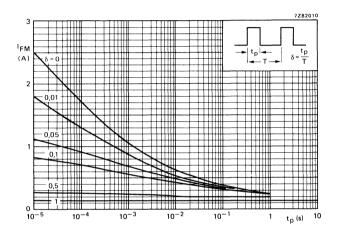


Fig. 2 T_{amb} = 25 °C; $T_{j peak}$ = 100 °C.

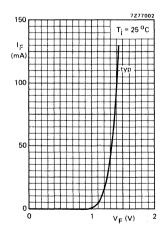


Fig. 3.

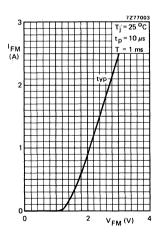


Fig. 4.

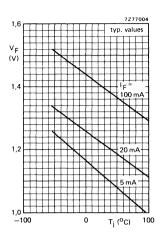


Fig. 5.

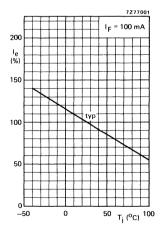


Fig. 7.

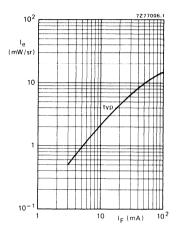


Fig. 6 $T_j = 25$ °C.

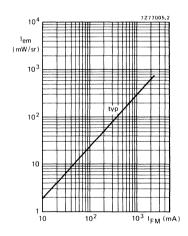


Fig. 8 T_{amb} = 25 °C; t_p = 10 μ s; T = 1 ms.

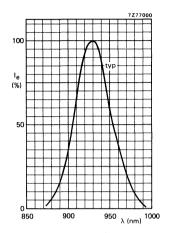


Fig. 9.

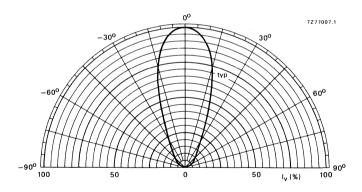


Fig. 10.

SECTION C1

Laser and fibre-optic components



SAFE OPERATION AND HANDLING OF LASER-DIODES

In the past, semiconductor laser-diodes have always been regarded as some of the more expensive semiconductor components. High cost restricted their use to professional and military applications, and even the use of laser-diodes in fibre-optic communications didn't lead to the expected price reduction. It has been the demand for laser diodes in compact disc players and Laservision systems that has stimulated large scale production with the result that these devices are readily available at low cost. Consequently, new applications, which were not previously economically worthwhile (such as bar code readers, distance and speed measurements etc.), are continually evolving and more companies than ever before are dealing with lasers for the first time. For all applications, the laser beam must be collimated and properly focused. It is therefore necessary to emphasise the dangers involved and the special requirements for handling lasers.

HANDLING RECOMMENDATIONS

Our laser-diodes are high quality devices. Handled correctly they are very reliable:

- Laser-diodes are extremely sensitive to electrostatic discharges. Always short-circuit the anode to
 the cathode when the diode is not in use. In addition, we recommend that persons handling the
 laser should be earthed, as well as their tools.
- Keep the laser-diode clean, both in use and in storage. This is particularly important for the lightemitting aperture.

OPERATING RECOMMENDATIONS

Once connected into the circuit, a laser diode can be damaged by:

- Transient current pulses and excessive currents. Electrically, the laser-diode is a reliable device and can tolerate substantial current surges, but optically, it is more easily damaged because of the extremely high flux passing through both facets, while in operation. To prevent gradual or instantaneous damage, the laser should be carefully controlled when it is switched on and off. You should also ensure that peak and mean power supply levels, radiant flux and forward current do not exceed the maximum ratings.
- High temperatures, which reduce device reliability and shorten lifetimes. We recommend using a
 heatsink and, as mentioned previously, carefully controlling the power supply. We also suggest you
 operate the laser-diode at the lowest temperature possible.

SAFETY RECOMMENDATIONS

The light from a semiconductor laser has a number of potential health risks associated with it. Because of material constraints, the light produced usually has a wavelength in the invisible infrared region that is of sufficient intensity to damage the retina. So take care to avoid looking directly at the light close to the source, especially with collimated beams, and avoid the optical axis at greater distances. You should also ensure there are no surfaces which can accidentally reflect the light. All laser-diode packages carry a warning label and the diodes fall within safety class 3B of the international standard code.



SILICON PHOTODIODE FOR FIBRE-OPTIC COMMUNICATIONS

Photo p-i-n diode in hermetic TO-46 encapsulation, designed for fibre-optic transmissions over short and medium distances, mainly for military and industrial applications.

It is optimized to be coupled with a 200 μm core diameter fibre and to be used in combination with the CQF24 emitter.

The crystal is electrically isolated from the case.

QUICK REFERENCE DATA

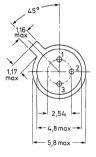
Continuous reverse voltage	V _R	max.	50 V
Dark reverse current at $V_R = 15 \text{ V}$ Total power dissipation up to $T_{amb} = 25 ^{\circ}\text{C}$	I _{R(D)} P _{tot}	max. max.	0,8 nA 100 mW
Diode capacitance at $V_R = 15 V$	C _d	max.	2,5 pF
Spectral sensitivity at $V_R = 15 \text{ V}$; $\lambda = 850 \text{ nm}$	\mathfrak{s}_λ	min.	0,4 A/W

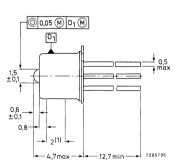
MECHANICAL DATA

Dimensions in mm

Fig. 1.
Pinning:
1 = anode
2 = cathode

3 = case





(1) Case diameter over this length is 4.7 (+0.05; -0.1) mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

	Eliming values in accordance with the Absolute Maximum dystem (12	0 10-7				
-	Continuous reverse voltage	v_R	max.	50	٧	
	Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	100	mW	
	Junction temperature	Tj	max.	150	οС	
	Operating temperature	T _{op}	-55 to -	+ 125	oC	
	Storage temperature	T _{stg}	–65 to −	150	оС	
	THERMAL RESISTANCE					
	From junction to ambient when the device is mounted on a printed circuit	R _{th j-a}	typ. max.		K/W K/W	
	From junction to case	R _{th j-c}	typ. max.		K/W K/W	
	CHARACTERISTICS					
	T _{amb} = 25 °C unless otherwise specified					
	Dark reverse current at $V_R = 15 V$	I _{R(D)}	max.	0,8	nA	
	Spectral sensitivity at $V_R = 15 \text{ V}$; $\lambda = 850 \text{ nm}$	s_λ	min. typ.		A/W A/W	
	Wavelength at peak response	λ_{p}	typ.	850	nm	
	Diode capacitance at V _R = 10 V	c _d	typ. max.	1,5 2,5	•	
	Switching times at V_R = 10 V; R_L = 50 Ω (10%-90%)	t _r t _f	max.	-	ns ns	

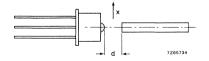


Fig. 2 Distance d and lateral displacement x.

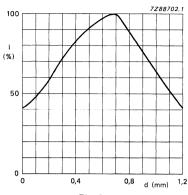
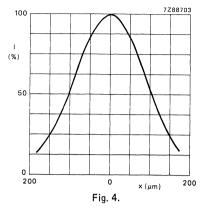


Fig. 3.

I_R (nA)

10-1

10-2



25 Fig. 5 $T_{amb} = 25$ °C.

ν_R (ν)

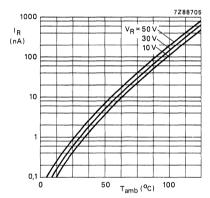


Fig. 6.

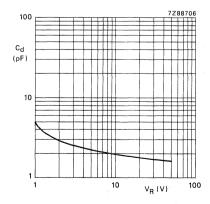


Fig. 7 f = 1 MHz; $T_{amb} = 25 \text{ °C}$.

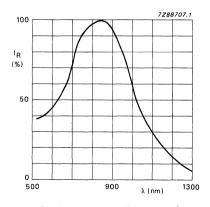


Fig. 8 $V_R = 10 V$; $T_{amb} = 25 °C$.

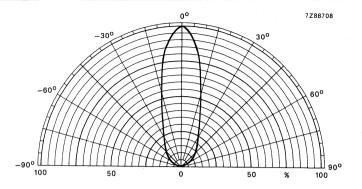


Fig. 9.

GaAlAs LIGHT EMITTING DIODE

Infrared light emitting diode in hermetic TO-46 encapsulation, designed for fibre-optic transmissions over short and medium distances, mainly for military and industrial applications.

It is optimized to be coupled with a 200 μm core diameter fibre and to be used in combination with the BPF24 receiver.

The crystal is electrically isolated from the case.

QUICK REFERENCE DATA

Continuous reverse voltage	VR	max.	3 V
Forward current (d.c.)	۱ _F	max.	100 mA
Total power dissipation up to T _{amb} = 25 °C	P_{tot}	max.	250 mW
Optical power coupled into fibre (ϕ core = 200 μ m and NA = 0,2) at I _F = 100 mA	$\phi_{\mathbf{e}}$	min.	200 μW
Switching times at I _F = 100 mA	t _r t _f	typ. typ.	10 ns 10 ns
Wavelength at peak emission	$\lambda_{\mathbf{p}}$	typ.	850 nm

MECHANICAL DATA

Dimensions in mm

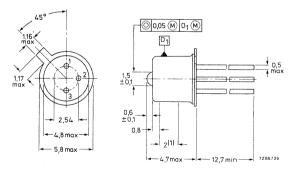
Fig. 1.

Pinning:

1 = anode

2 = cathode

3 = case



(1) Case diameter over this length is 4,7 (+0,05; -0,1) mm.

RATINGS							
Limiting values in accordance with the Absolute Maximum System (IEC 134)							
Continuous reverse voltage	٧ _R	max.	3	V			
Forward current	lF	max.	100	mA			
Forward current (peak) $t = 10 \mu s; \delta = 0,1$	^I FM	max.	300	mA			
Total power dissipation up to T _{amb} = 25 °C device mounted on a printed circuit	P _{tot}	max.	250	mW			
Junction temperature	T _i	max.	150	оС			
Operating temperature	Top	-55 to +	125	°C			
Storage temperature	T _{stg}	-65 to +	150	°C			
THERMAL RESISTANCE							
From junction to ambient when the device is mounted on a printed circuit	R _{th j-a}	typ. max.		K/W K/W			
From junction to case	R _{th j-c}	typ. max.		K/W K/W			
CHARACTERISTICS							
T _{amb} = 25 °C unless otherwise specified							
Forward voltage at I _F = 100 mA	V _F	typ. max.	1,9 2,5				
Reverse current at V _R = 3 V	^I R	max.	100	μΑ			
Radiant power coupled into fibre at I _F = 100 mA ϕ core = 200 μ m, NA = 0,2	$\phi_{ extsf{e}}$	min. typ.	200 400	•			
Radiant intensity at $I_F = 100 \text{ mA}$	l _e	min.		mW/sr			
Wavelength at peak emission	λ_{p}	min. typ. max.	820 850 880	nm			

Δλ

tr

tf

typ.

typ.

max.

typ.

max.

40 nm

10 ns

15 ns 10 ns

15 ns

Spectral width at half height

at $I_{Fon} = 100 \text{ mA}$

Switching times

NOTES

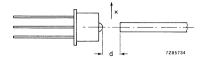


Fig. 2 Distance d and lateral displacement x.

1. For this measurement the device is shifted along its 3 axes, so that the maximum power is coupled into the fibre.

If the device is adjusted in front of the geometrical axis of the same fibre with distance d = 0,7 mm, P_{min} = 100 μ W.

2. For a different core diameter $\phi_X \le 200 \ \mu m$: $\frac{P_{inj}(x)}{P_{inj}(200)} = \left(\frac{\phi_X}{200}\right)^2$

For a different numerical aperture NA_X \leq 0,2: $\frac{P_{inj}(x)}{P_{inj}(0,2)} = \left(\frac{NA_X}{0,2}\right)^2$

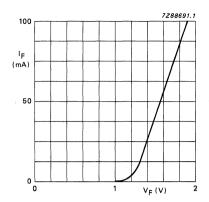


Fig. 3 $T_{amb} = 25$ °C.

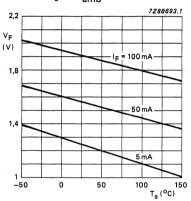


Fig. 5.

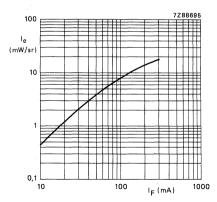


Fig. 7 T_{amb} = 25 °C; T_{on} = 10 μ s; δ = 0,01.

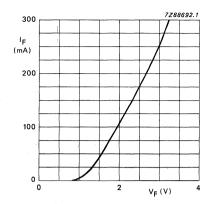


Fig. 4 T_{amb} = 25 °C; T_{on} = 10 μ s; δ = 0,1.

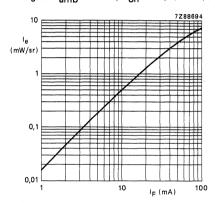


Fig. 6 $T_{amb} = 25$ °C.

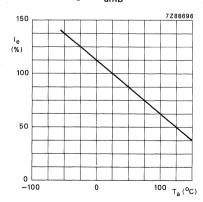


Fig. 8.

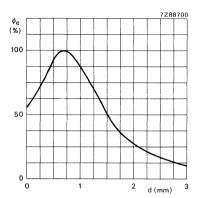


Fig. 9 See notes 1 and 2.

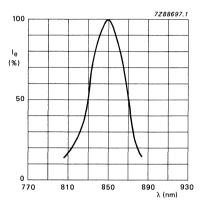


Fig. 11 $I_F = 100 \text{ mA}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

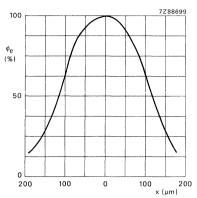


Fig. 10 Distance d = $700 \mu m$. See notes 1 and 2.

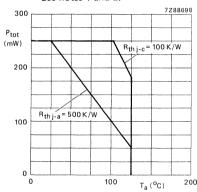


Fig. 12.

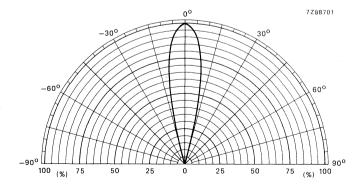


Fig. 13.

DOUBLE HETEROSTRUCTURE AIGAAS LASER

The CQL10A is designed for reading applications such as: video-audio disc applications, optical memories. security systems, etc.

This device is mounted in an hermetic SOT-148 encapsulation specifically designed for easy alignment in an optical read or write system. The copper heatsink is circular and precision engineered with a diameter accuracy of +0, -9 μm. Laser-stripe and mechanical axis coincide within 50 μm.

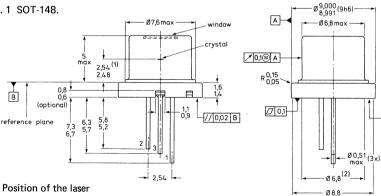
The CQL10A is standard equipped with a photo p-i-n diode, optically coupled to the rear emitting facet of the laser. This fast responding (less than 20 ns) photodiode can be used as a sensor to control the laser radiant output level. The ultra-flat top window (flat within two fringes) guarantees an unperturbed beam wavefront.

QUICK REFERENCE DATA

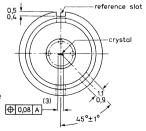
Threshold current at T _c = 30 °C	l _{th}	typ.	65 mA
C.W. radiant output power up to $T_c = 60$ °C	ϕ_{e}	typ.	5 mW
Wavelength at peak emission	λ_{p}	typ.	820 nm

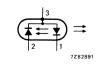
MECHANICAL DATA

Fig. 1 SOT-148.



- (1) Position of the laser crystal from the reference plane.
- (2) Within the plane of ϕ 6,8 protrusions and irregularities are permitted.
- (3) The positional accuracy of the laser stripe with respect to the flange diameter.





Dimensions in mm

in this plane

protrusions

7Z85815

LASER

The double heterostructure stripe laser operates in single transverse, multiple longitudinal mode (TE_{OO}) over the full power range. The structure is designed to operate C.W. 5 mW up to relatively high temperatures (60 °C case temperature) and a wavelength of 820 nm which makes reading standard Video Long Play records and compact discs (DAD) a possible application.

RATINGS

RATINGS					
Limiting values in accordance	with the Absolute Maximum System (IE	C 134)			
Radiant output power		ϕ_{e}	max.	10	mW
Reverse voltage		v_R	max.	1	٧
Temperatures (both laser and C.W. operation storage	photodiode)	T _c T _{stg}	-20 to -55 to		
CHARACTERISTICS					
Threshold current at $T_C = 30$ °C at $T_C = 60$ °C		l _{th}	typ.		mA mA
Operating current $\phi_e = 5 \text{ mW}; T_c = 30 ^{\circ}\text{C}$		l _{op}	typ.	120	mA mA
ϕ_{e} = 5 mW; T_{c} = 60 °C		lop	typ. max.		mA mA
Recommended operating radia up to $T_c = 60$ °C		$\phi_{ extsf{e}}$	typ.		mW
Forward voltage drop up to T, $\phi_e = 5 \text{ mW}$	c = 60 °C	V _F	typ.	2,5	V
Wavelength at peak emission $\phi_{\rm e}$ = 5 mW; T _C = 30 °C		λρ	typ.	820	nm
Spectral width at half height $\phi_e = 5 \text{ mW}$		Δλ	typ.	4	nm
Far-field angle at half-intensit perpendicular to the junction parallel to the junction plar	on plane	α _{50%} (⊥) α _{50%} (II)	typ. typ.	50 35	
Near-field width at half-intens	sity directions (FWHM)	δ 50 %	typ.	6-7	μm
Astigmatism (distance betwee	en focal lines)	A_D	typ.	15	μm
Series resistance		R_S	typ.	5	Ω
Differential efficiency at ϕ_e =	2 mW	ϵ	typ.	0,15	W/A
Spontaneous emission at Ith		$\phi_{\sf spon}$	typ.	0,5	mW
Turn-on/turn-off time (above	threshold)	t _{on} /t _{off}	typ.	1	ns
Degradation rate $T_c = 60 \text{ QC}$; $\phi_e = 5 \text{ mW}$		$\frac{1}{l_{op}} \cdot \frac{dlo}{d}$	<u>p</u> typ.	5	%/Kh
Temperature coefficient of wa	avelength	$\frac{d\lambda pk}{dT}$	typ.	0,25	nm/K
Temperature coefficient of Ith	h	$\frac{1}{1 \text{th}} \cdot \frac{\text{dlth}}{\text{dT}}$	typ.	1	%/K
Thermal resistance from junction to case		R _{th j-c}	typ.	50	K/W

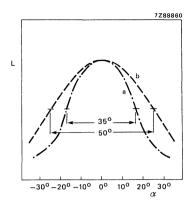


Fig. 2 Far-field pattern.

- a. parallel to the junction plane.
- b. perpendicular to the junction plane.

PHOTODIODE

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

30 V Reverse voltage V_R max.

CHARACTERISTICS

Luminous sensitivity at V _R = 15 V	N	typ.	0,5	A/W
Dark reverse current at V _R = 15 V	R(D)	max.	10	nA
Capacitance at V _R = 0	c_d	max.	5	pF
Monitor diode current at V _R = 15 V	I _{R(L)}	150	0-400	μ A/mW

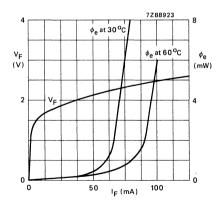


Fig. 3 Forward voltage drop (V_F) and radiant output power (ϕ_e) of laser diode as a function of forward current; typ. values.

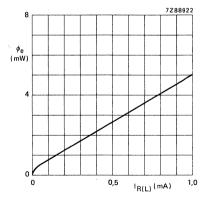
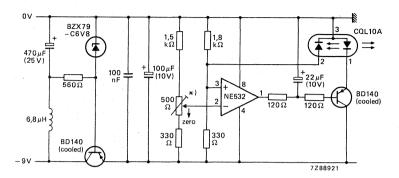


Fig. 4 Radiant output power (ϕ_e) as a function of monitor current of photodiode; VR (photodiode) = 15 V; typ. values.



* Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current. Adjust from zero position.

Fig. 5 Recommended control circuit for continuous operation.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the laser diode is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they can substantially decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

COLLIMATOR PEN

The collimator pen CQL13A is used for reading applications such as: data retrieval, video-audio disc applications, optical memories, security systems etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.

The housing is circular and precision manufactured with a diameter accuracy between + 0 and $-11 \mu m$.

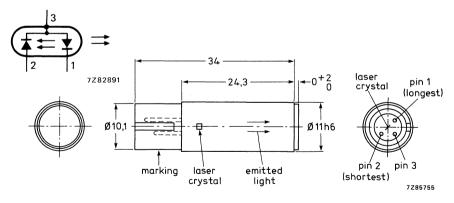
QUICK REFERENCE DATA

Output power ϕ_{e}		2 mW
Current at output power ϕ_e = 2 mW and temperature of 60 °C	<	175 mA
Wavelength at peak emission λ_p	typ.	820 nm
Wavefront form of bundle (non-convergent) divergence	<	0,3 mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass

max, 8 q

Concentricity

angle between the mechanical and optical axis ≤ 10 mrad

Marking

type number CQL13A and serial number

Mounting

on a p.c. board by means of a specifically designed connector

Accessories

the pen is supplied with a connector

WARNING

THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE

POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

Climatological relative humidity 5-90%, atmospheric pressure. Housing temperature of the pen

5-60 °C

Electrical d.c. operation, optical feedback drive and protection against transients

Optical only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output power ϕ_{e} max. 2 mW (see Fig. 4)

Spectral

wavelength λ 820 ± 10 nm bandwidth $\Delta\lambda$ <4 nm (see note) wavelength drift $\Delta\lambda/\Delta T$ approx. 0.25 nm/K

Bundle properties

dimension ϕ 5,4 mm

wavefront form plane, non-convergent divergence < 0,3 mrad aberrations variance of wavefront with respect to the

Gaussian reference sphere is less than $\lambda^2/300$

polarization plane polarization ratio plane typ. 35 : 1

polarization ratio typ. 39
Intensity distribution

transversal mode TE₀₀-fundamental

longitudinal mode see note symmetry variation of optical power in the four quadrants

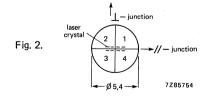
(see Fig. 2) typ. 20%

ripple local value of the intensity < 15% of the

smooth value

filling ratio I_{rim}/I_{max} > 0,17

Note: the number of longitudinal modes is related to the spectral width.



Electrical data

Current

at $\phi_{\rm e}$ = 2 mW and T_h = 60 °C \leq 175 mA

Drive voltage V_d $\leq 5 V$

Resistance between collimator pen and connector at 10 mA, max. 20 mV_{DD} and 1 kHz ≤

≤12 mΩ

PHOTODIODE (see Fig. 5)

RATINGS

Reverse voltage

V_R ≤ 30 V

<

CHARACTERISTICS

Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 2 mW

0,1 A/W

Dark reverse current

at V_R = 15 V

 $I_{R(D)} <$

10 nA

Capacitance at V_R = 0

 C^{q}

5 pF

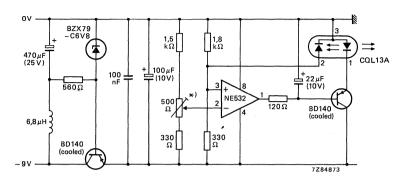
ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	-25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: -25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10—55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s ² Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s² Number of bumps: 1000 Axes of direction: 6

Cleaning test

The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–95% solution of ethyl-alcohol in water, attached to the end of a small stick.



 Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current.

Fig. 3 Recommended control circuit.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

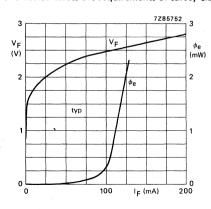


Fig. 4 $T_h = 60$ °C.

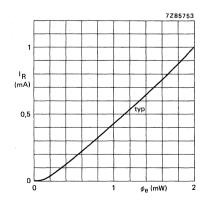


Fig. 5 $V_{R} = 15 V$.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

COLLIMATOR PEN

The collimator pen CQL16 is used as a laser source in measuring equipment such as telemetry, leveller and security systems.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited.

The housing is circular and precision manufactured with a diameter accuracy between + 0 and $-11 \mu m$.

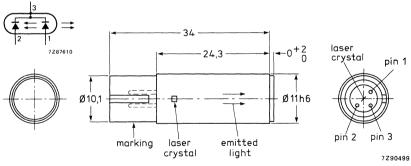
QUICK REFERENCE DATA

Output power	$\phi_{\mathbf{e}}$	max.	2 mW
Current			
at $\phi_{ m e}$ = 2 mW and T _h = 60 °C	1	max.	100 mA
Wavelength at peak emission	λ_{p}	typ.	780 nm
Wavefront form of bundle (non-convergent)			
divergence		max.	0,3 mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass

max. 8 g

Concentricity

angle between the mechanical and optical axis ≤ 10 mrad

Marking

type number CQL16 and serial number

Mounting

on a p.c. board by means of a specifically designed connector

Accessories

the pen is supplied with a connector

WARNING

THE LASER, AND CONSEQUENTLY THE COLLIMATOR PEN, HAS NEGATIVE

POLARITY ON THE CASE.

The LASER is protected by an antistatic spring which shall NOT be removed before

the pen is installed in the connector.

CHARACTERISTICS

Measuring conditions

Climatological relative humidity 5-90%, atmospheric pressure. Housing temperature of the pen

5-60 °C

Electrical d.c. operation, optical feedback drive and protection against transients

Optical only the radiation in a stripe with dimensions 5,4 mm x 3 mm is relevant

Optical data

Output power $\phi_{\mathbf{e}}$ max. 2 mW

Spectral

wavelength λ 780 ± 10 nm bandwidth $\Delta\lambda$ <2 nm

wavelength drift $\Delta \lambda / \Delta T$ approx. 0,25 nm/K

Bundle properties

dimensions stripe 5,4 mm x 3 mm, FWHM* wavefront form plane, non-convergent, divergence < 0,3 mrad

aberrations variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$

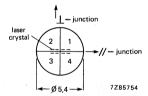
polarization plane polarization ratio plane typ. 60 : 1

polarization ratio typ. 60
Intensity distribution

transversal mode TE₀₀-fundamental

symmetry spot width 1 to junction 5,4 mm

spot width // to junction 3,0 mm, FWHM*



Electrical data

Current

at ϕ_e = 2 mW and T_h = 60 °C I \leq 100 mA Drive voltage V_d \leq 5 V

Resistance between collimator pen

and connector at 10 mA, max. 20 mV_{DD} and 1 kHz \leq 12 m Ω

^{*} FWHM means full width half maximum.

5 pF

PHOTODIODE

RATINGS

Reverse voltage	v_R	\leq	30 V
-----------------	-------	--------	------

CHARACTERISTICS

Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at $\phi_{e} = 2 \text{ mW}$

at $\phi_{\rm e}$ = 2 mW typ. 0,6 A/W Dark reverse current

at V_R = 15 V Capacitance

at V_R = 0

 $I_{R(D)}$ < 10 nA

<

 C_{c}

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	-25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: -25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90-95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temp./R.H. 45 ºC/100% (12 h) to 25 ºC/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10-55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s ² Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s ² Number of bumps: 1000 Axes of direction: 6

Cleaning test

The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45-95% solution of ethyl-alcohol in water, attached to the end of a small stick.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BURIED HETEROJUNCTION InGaAsP LASER DIODE WITH FIBRE PIGTAIL

The 502CQF is an InGaAsP buried heterojunction semiconductor laser diode. The device is designed for high-speed long distance, optical communications and data transmissions.

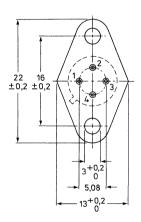
The diode laser, emitting in the 1300 nm transmission window of optical fibres, is mounted in a specifically designed hermetic SOT-184 encapsulation.

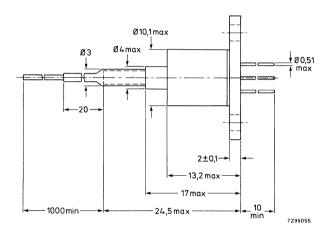
The 502CQF is standard equipped with a fast-responding photodiode optically coupled to the rear facet of the laser for monitoring the laser radiant output power. A graded index optical fibre pigtail with dimensions $50/125/950 \, \mu m$ is coupled to the front facet of the laser.

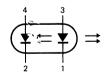
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-184.







LASER

The buried heterojunction InGaAsP laser is designed to operate at a radiant output level of up to 3 mW in the fibre, up to relatively high case temperatures (60 °C) and at an emission wavelength of 1300 nm.

All lasers have been subjected to a burn-in test at a radiant output level of 3 mW at a case temperature of 60 °C.

RATINGS

Limiting values in accordance with the Absolute Maxin	mum System (IE	C 134)		
Radiant output power from fibre pigtail	ϕ_{e}	max.	3	mW
CHARACTERISTICS				
Threshold current $T_c = 30 ^{\circ}C$	l _{th}	typ. max.		mA mA
Radiant output power from fibre pigtail $T_c = 60 {}^{\circ}\text{C}$	$\phi_{\mathbf{e}}$	max.	3	mW
Forward voltage drop $\phi_e = 2 \text{ mW}$	VF	max.	1,5	V
Wavelength at peak emission	λр	typ.	1300	nm
Spectral width at half intensity at 10% intensity	Δλ	max.	1 4	nm nm
Rise time, fall time laser biased near l _{th}	t _r , t _f	typ.	0,5	ns
Temperature coefficient of wavelength	d\frac{d}{d}	typ.	0,5	nm/K
Temperature coefficient of threshold current	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dT}$	typ.	. 2	%/K
Differential efficiency (stimulated emission)	ϵ	typ.	0,1	mW/mA
Extinction ratio $\phi_e = 3 \text{ mW}$		typ.	1:50	
PHOTODIODE				
Reverse voltage	VR	max.	5	V
Dark reverse current				
$V_R = 5 V$	IRD	typ.	10	μΑ
Monitor diode current	IR		100 to 300	μ A/mW

FIBRE PIGTAIL

Graded index silica rubber		min.	typ.	max.
numerical aperture on axis	NA	0,20	0,21	0,22
core diameter	$\phi_{ extsf{core}}$	48	50	52 μm
cladding diameter	ϕ_{clad}	123	125	127 μm
primary coating thickness	$\phi_{ extsf{pc}}$		20	μm
secondary coating diameter	$\phi_{ extsf{sc}}$		950	μm

Options: other fibre for pigtail may be accommodated.

Options may be subject to surcharge.

TEMPERATURES (total assembly)

C.W. operation	T_{op}		0 to 60 °C
Storage	T_{stg}		-40 to +100 °C
Thermal resistance			
from junction to case	R _{th j-c}	typ.	45 K/W

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets.

Current transients should therefore be carefully avoided; they can substantially decrease the laser life time and may cause mortal damage. Before connecting the laser to the supply circuit, make sure that there are no transients which could make the laser output exceeding the maximum ratings for radiant flux or forward current. The connection and disconnection of the laser to or from a power supply must be made only after reducing the voltage to the minimum and setting the output control to the zero position.

Avoid poor electrical connection on the load side of the power supply circuit, as this may cause the laser voltage to rise if the power supply is operated in constant current mode.

WARNING

The laser diode is extremely sensitive to electrostatic discharges. The anode and the cathode shall therefore always be shorted when the diode is disconnected.

CAUTION

Indium gallium arsenide phosphide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

Note: Each laser is accompanied by an individual test sheet, showing the P_{opt} - I_{op} characteristic and the monitor current for a given optical output power.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BURIED HETEROJUNCTION InGaAsP LASER DIODE WITH SINGLE MODE FIBRE PIGTAIL

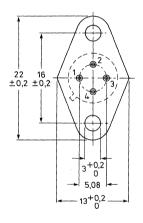
The 503CQF is an InGaAsP buried heterojunction semiconductor laser diode. The device is designed for high-speed long distance, optical communications and data transmissions.

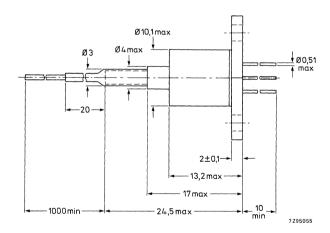
The diode laser, emitting in the 1300 nm transmission window of optical fibres, is mounted in a specifically designed hermetic encapsulation (modified TO-5). The 503CQF is standard equipped with a fast-responding photodiode optically coupled to the rear facet of the laser for monitoring the laser radiant output power. A single mode optical fibre pigtail with dimensions $8/125/950~\mu m$ is coupled to the front facet of the laser.

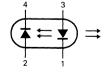
MECHANICAL DATA

Fig. 1 SOT-184.

Dimensions in mm







503CQF

LASER

The buried heterojunction InGaAsP laser is designed to operate at a radiant output level of up to 2 mW in the fibre, up to relatively high case temperatures (60 °C) and at an emission wavelength of 1300 nm. All lasers have been subjected to a burn-in test at a radiant output level of 2 mW at a case temperature of 60 °C.

Limiting values in accordance with the Absolute Maximum System (IEC 134)

RATINGS

Limiting values in accordance with the Absolute Maxin	num System (IE)	5 134)		
Radiant output power from fibre pigtail	ϕ_{e}	max.	2	mW
CHARACTERISTICS				
Threshold current				
$T_c = 30 \text{ oC}$	l _{th}	typ.		mA mA
		max.	40	mA
Radiant output power from fibre pigtail			4.5	
$T_c = 60$ oC	$\phi_{ extsf{e}}$	max.	1,5	mW
Forward voltage drop				
ϕ_{e} = 2 mW	VF	max.	1,5	V
Wavelength at peak emission	$\lambda_{\mathbf{p}}$	typ.	1300	nm
Spectral width				
at half intensity	Δλ	max.	1	nm
at 10% intensity		max.	4	nm
Rise time, fall time				
laser biased near I _{th}	t _r , t _f	typ.	0,5	ns
Towns on the state of the state	dλp			110
Temperature coefficient of wavelength	dT	typ.	0,5	nm/K
Townson town as officient of the solution of t	1 dl _{th}		•	0/ /1/
Temperature coefficient of threshold current	$\overline{I_{th}} \cdot \overline{dT}$	typ.	2	%/K
Differential efficiency				
(stimulated emission)		typ.	0,1	mW/mA
Extinction ratio				
$\phi_e = 1.5 \text{ mW}$	ϵ	typ.	1:50	
PHOTODIODE				
Reverse voltage	VR	max.	5	V
Dark reverse current				
V _R = 5 V	^I RD	typ.	20	μΑ
Monitor diode current	1 _R		100 to 300	$\mu A/mW$

FIBRE PIGTAIL

Single mode		min.	typ.	max.
mode field diameter	¢ core		8	μm
excentricity of core				1,5 μm
cladding diameter	ϕ clad	123	125	127 μm
primary coating thickness	$\phi_{ extsf{pc}}$		20	μm
secondary coating diameter	$\phi_{ extsf{sc}}$		950	μm

Options: other fibre for pigtail may be accommodated.

Options may be subject to surcharge.

TEMPERATURES (total assembly)

C.W. operation	T_{op}		0 to 60	oC
Storage	T_{stg}	-	-40 to +100 °	οС
Thermal resistance				
from junction to case	R _{th i-c}	typ.	45	K/W

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets.

Current transients should therefore be carefully avoided; they can substantially decrease the laser life time and may cause mortal damage. Before connecting the laser to the supply circuit, make sure that there are no transients which could make the laser output exceeding the maximum ratings for radiant flux or forward current. The connection and disconnection of the laser to or from a power supply must be made only after reducing the voltage to the minimum and setting the output control to the zero position.

Avoid poor electrical connection on the load side of the power supply circuit, as this may cause the laser voltage to rise if the power supply is operated in constant current mode.

WARNING

The laser diode is extremely sensitive to electrostatic discharges. The anode and the cathode shall therefore always be shorted when the diode is disconnected.

CAUTION

Indium gallium arsenide phosphide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

Note: Each laser is accompanied by an individual test sheet, showing the P_{opt} - I_{op} characteristic and the monitor current for a given optical output power.

Dimensions in mm

7295037.1

This data sheet contains advance information and specifications are subject to change without notice.

AIGaAs DOUBLE HETEROSTRUCTURE VISIBLE LASER-DIODE

The 504CQL is designed for reading applications such as: video-audio disc applications, optical memories, security systems, etc.

This device is mounted in an hermetic SOT-148 encapsulation specifically designed for easy alignment in an optical read system. The copper heatsink is circular and precision engineered with a diameter accuracy of +0, $-9 \mu m$. Laserstripe and mechanical axis coincide within 50 μm .

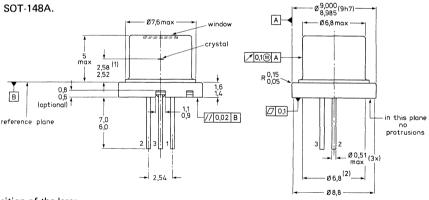
The 504CQL is standard equipped with a photo p-i-n diode, optically coupled to the rear emitting facet of the laser. This fast responding (less than 20 ns) photodiode can be used as a sensor to control the laser radiant output level. The ultra-flat top window (flat within two fringes) quarantees an unperturbed beam wavefront.

QUICK REFERENCE DATA

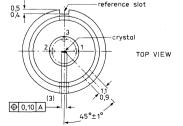
Threshold current at T_c = 30 °C 60 mA Ith typ. C.W. radiant output power up to $T_c = 60$ °C 5 mW ◀ фе typ. Wavelength at peak emission 780 nm λp typ.

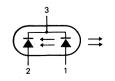
MECHANICAL DATA

Fig. 1 SOT-148A.



- (1) Position of the laser crystal from the reference plane.
- (2) Within the plane of ϕ 6.8 protrusions and irregularities are permitted.
- (3) The positional accuracy of the laser strip with respect to the flange diameter.





504CQL (CQL20)

LASER

The double heterostructure stripe laser is made by using internal current confinement. The structure is designed to operate C.W. 5 mW at a wavelength of 780 nm. The device is primarily intended for reading applications of Compact Discs (DAD) and Video Long Play records.

All lasers have been subjected to a burn-in test at rated radiant output level and at elevated case temperature.

► RATINGS

Limiting values in accordance with the Absolute Maximu	ım System (IEC 134)			
Radiant output power	$\phi_{ extsf{e}}$	max.	7	mW
Reverse voltage	VR	max.	2	٧
Temperatures (both laser and photodiode)				
c.w. operation storage	Т _с Т _{stg}		o + 60 o + 85	
► CHARACTERISTICS				
Threshold current at $T_c = 30$ °C at $T_c = 60$ °C	l _{th} I _{th}	typ. typ.		mA mA
Operating current $\phi_e = 5 \text{ mW}$; $T_c = 30 \text{ °C}$	lop	typ. max.	80 100	mA mA
Recommended operating radiant output power up to $T_{\text{C}} = 60 {}^{\text{O}}\text{C}$	$\phi_{\mathbf{e}}$	typ.	5	mW
Forward voltage drop up to T_c = 60 °C ϕ_e = 5 mW	V _F	typ. max.	1,7 2,2	
Wavelength at peak emission $\phi_{\rm e}$ = 5 mW; T _c = 30 °C	λ_{p}	780	0 ± 15	nm
Spectral width at half height $\phi_{ m e}$ = 5 mW	Δλ	typ.	2	nm
Far-field angle at half-intensity directions (FWHM)* $\phi_{\rm e}$ = 2 mW; T _C = 30 °C perpendicular to the junction plane parallel to the junction plane	$egin{array}{ll} heta_{1/2} & (oldsymbol{\perp}) \ heta_{1/2} & (oldsymbol{\parallel}) \end{array}$	typ.	30 12	
Astigmatism (distance between focal lines)	AD	typ.	11	μm
Series resistance	RS	typ.		Ω
Differential efficiency at ϕ_e = 2 mW	ϵ	typ.	0,25	W/A
Spontaneous emission at I _{th}	$\phi_{ extsf{spon}}$	typ.	0,1	mW
Turn-on/turn-off time (above threshold)	t _{on} /t _{off}	typ.	1	ns
Temperature coefficient of wavelength	$\frac{d\lambda_{\mathbf{p}}}{dT}$	typ.	0,25	nm/K
Thermal resistance				
from junction to case	R _{th j-c}	typ.	50	K/W

^{*} FWHM stands for full width half maximum.

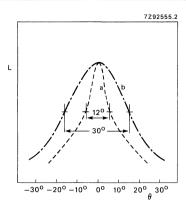


Fig. 2 Far-field pattern.

- a. parallel to the junction plane.
- b. perpendicular to the junction plane.

PHOTODIODE

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage VR max. 30 V

CHARACTERISTICS

Luminous sensitivity at $V_R = 15 \text{ V}$ Dark reverse current at $V_R = 15 \text{ V}$ Capacitance at $V_R = 0$

Monitor diode current response at $V_R = 7.5 V$

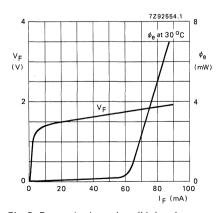
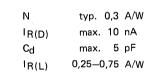


Fig. 3 Forward voltage drop (VF) and radiant output power (ϕ_e) of laser diode as a function of forward current; typical values.



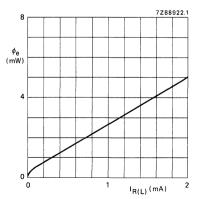


Fig. 4 Radiant output power (ϕ_e) as a function of monitor current of photodiode; V_R (photodiode) = 7,5 V; typical values.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets.

Current transients should therefore be carefully avoided; they can substantially decrease the laser life time and may cause mortal damage. Before connecting the laser to the supply circuit, make sure that there are no transients which could make the laser output exceeding the maximum ratings for radiant flux or forward current. The connection and disconnection of the laser to or from a power supply must be made only after reducing the voltage to the minimum and setting the output control potentiometer to the zero position.

Avoid poor electrical connection on the load side of the power supply circuit, as this may cause the laser voltage to rise if the power supply is operated in constant current mode.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

WARNING

The laser diode is extremely sensitive to electrostatic discharges. The anode and the cathode shall therefore always be shorted when the diode is disconnected.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

DOUBLE HETEROSTRUCTURE AIGaAs DIODE LASER WITH FIBRE PIGTAIL

The 516CQF-B is an AlGaAs double heterostructure semiconductor laser designed for high speed (560 Mb/s), long distance, optical communications.

The diode laser, emitting in the first transmission window of silica optical fibres, is mounted in a specifically designed hermetic encapsulation.

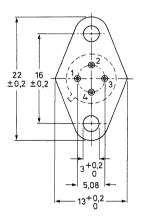
The 516CQF-B is standard equipped with a fast-responding photodiode optically coupled to the rear facet of the laser for monitoring the laser radiant output power. A silica graded index optical fibre pigtail is coupled to the front facet of the laser.

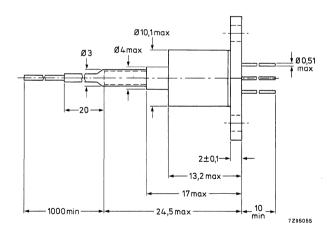
The monitor diode is electrically insulated from the case.

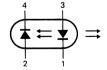
MECHANICAL DATA

Fig. 1 SOT-184.

Dimensions in mm







LASER

The double heterostructure laser, made by means of the MOVPE process, with very narrow stripe operates in a stable single transverse mode (TE_{OO}) over the full power range and in several longitudinal modes. This results in a rather short coherence length, which is advantageous in suppressing modal noise and optical feedback effects.

The structure is designed to operate at a radiant output level of up to 3 mW in the fibre, up to relatively high case temperatures (60 °C) and at an emission wavelength of 850 nm.

All lasers have been subjected to a burn-in test at radiant output level from the laser facet of 5 mW at a case temperature of 60 °C.

RA	TI	N	G	S
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na neo				
Limiting values in accordance with the Absolute Maximum S	System (IEC 1	34)		
Radiant output power from fibre pigtail	$\phi_{\mathbf{e}}$	max.	5	mW
Reverse voltage	v_R	max.	1	V
CHARACTERISTICS				
Threshold current				
$T_{c} = 30 \text{ oC}$	I _{th}	typ.	90	mA
$T_C = 60 \text{ oC}$	I _{th}	typ. max.	120 150	mA mA
Radiant output power from fibre pigtail				
$T_{C} = 60 {}^{\circ}C$	ϕ_{e}	typ.	3	mW
Forward voltage drop	.,		0.5	
ϕ_{e} = 3 mW	۷F	typ.	2,5	
Wavelength at peak emission	λp	typ.	850	
Spectral width at half intensity	Δλ	typ.	3	nm
Rise time, fall time				
laser biased near I _{th}	t _r , t _f	typ.	0,5	ns
Spectrum at ϕ_{e} = 1 mW (FWHM)		typ.	10	longitudi- nal modes
Extinction ratio at $\phi_e = 3 \text{ mW}$			1 : 10	
Temperature coefficient of wavelength	d\(\text{d} \)	typ.	0,25	nm/K
Temperature coefficient of I _{th}	$\frac{1}{l_{th}} \cdot \frac{dl_{th}}{dt}$	typ.	1	%/K
Differential efficiency (stimulated emission)	ϵ	typ.	0,1	mW/mA
PHOTODIODE				
Reverse voltage	٧R	max.	30	V
Responsitivity $V_R = 15 V$	N	typ.	0,5	A/W
Dark reverse current V _R = 15 V	I _{RD}	max.	10	nA
Capacitance				
V _R = 0	Cd	max.	5	pF
Monitor diode current	lF		100 to 300	μ A/mW

FIRRE PIGTAIL

Graded index silica		min.	typ.	max.
numerical aperture on axis	NA	0,20	0,21	0,22
core diameter	$\phi_{ extsf{core}}$	48	50	52 μm
cladding diameter	ϕ_{clad}	123	125	127 μm
primary coating thickness	$\phi_{ m DC}$		20	μ m
secundary coating diameter	φer		950	μm

Options: other fibre for pigtail may be made available.

other wavelengths are available and are specified by adding a suffix to the type number

accordingly:

suffix A = 820 nm = 850 nmsuffix B suffix C = 870 nm

Options may be subject to surcharge.

TEMPERATURES (total assembly)

C.W. operation	T_{op}	0 to 60 °C
Storage	T_{stg}	−20 to +100 °C
Thermal resistance		
junction to case	Rebin typ.	45 K/W

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm²), causing gradual or catastrophic degradation of the laser facets.

Current transients should therefore be carefully avoided; they can substantially decrease the laser life time and may cause mortal damage. Before connecting the laser to the supply circuit, make sure that there are no transients which could make the laser output exceed the maximum ratings for radiant flux or forward current. The connection and disconnection of the laser to or from a power supply must be made only after reducing the voltage to the minimum and setting the output control to the zero position.

Avoid poor electrical connection on the load side of the power supply circuit, as this may cause the laser voltage to rise if the power supply is operated in constant current mode.

WARNING

The laser diode is extremely sensitive to electrostatic discharges. The anode and the cathode shall therefore always be short-circuited when the diode is disconnected.

CAUTION

Aluminum gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

Note: Each laser is accompanied by an individual test sheet, showing the ϕ_{e} - I_{op} characteristic and the monitor current for a given optical output power.

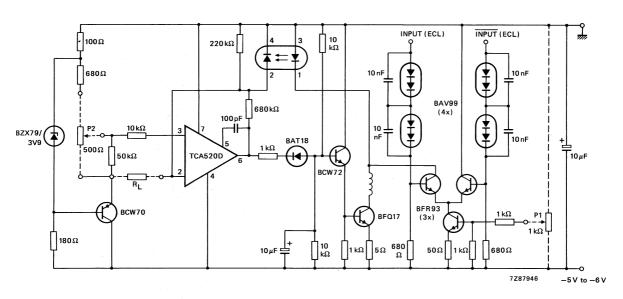


Fig. 2 Typical modulation circuit with ECL logic input and control of average optical power output. Data rate > 200 Mb/s.

P₁ sets the peak-peak modulation current.

P2 sets the laser bias current.

R_L determines maximum mean value of optical output power.

1-2-3-4 laser connections.

Note: if single ECL drive is applied, the other input shall be connected to the ECL threshold level (-1,35 V).

SECTION C2

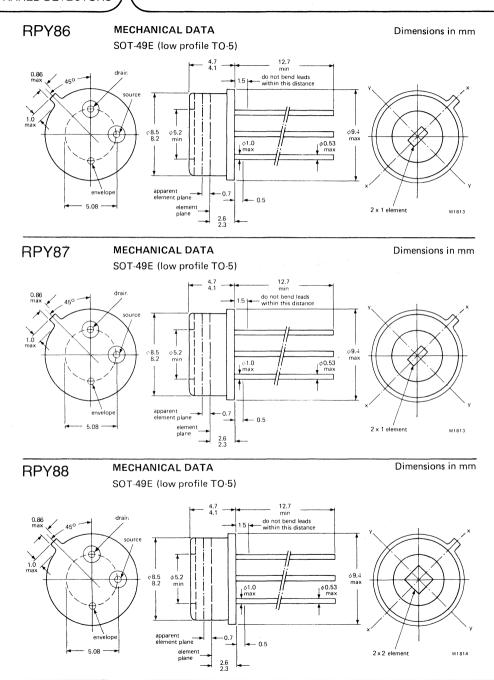
Infrared sensors

PYROELECTRIC INFRARED DETECTORS

In line with our policy of continual improvement, some of our original ceramic pyroelectric detectors have been superseded by more advanced, lower-cost devices. The tables on the following pages give details of the original detectors and their replacements. Greater detail for the current types is available in our published data.

The replacement types are specified with a unity gain source follower circuit. The responsivity levels will therefore appear to be approximately x 5 lower than the types they replace, since the latter were specified with a gain of x 4.8 with the exception of the RPY96, which was specified with a unity gain source follower circuit.

OBSOLESCENT TYPES



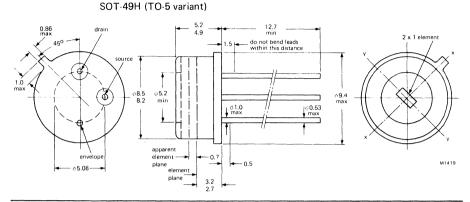
REPLACEMENT TYPES

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTORS

RPY100

MECHANICAL DATA

Dimensions in mm

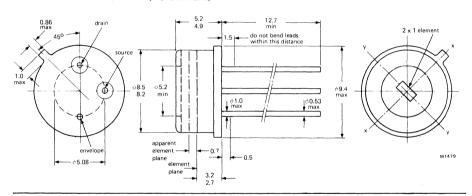


RPY107

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm

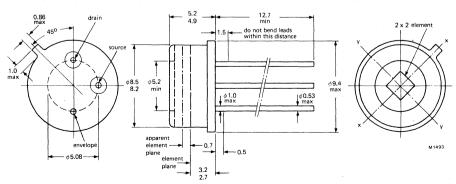


RPY102

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



SINGLE ELEMENT PYROELECTRIC INFRARED DETECTORS

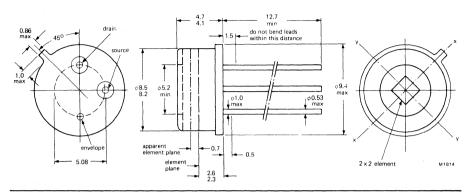
OBSOLESCENT TYPES

RPY89

MECHANICAL DATA

SOT-49E (low profile TO-5)

Dimensions in mm

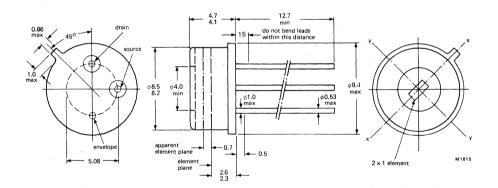


RPY96

MECHANICAL DATA

SOT-49F (low profile TO-5)

Dimensions in mm



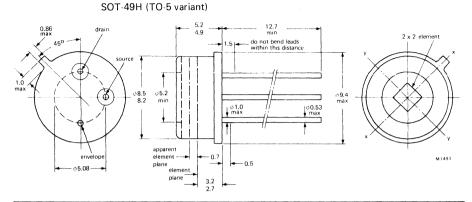
REPLACEMENT TYPES

SINGLE ELEMENT
PYROELECTRIC
INFRARED DETECTORS

RPY109

MECHANICAL DATA

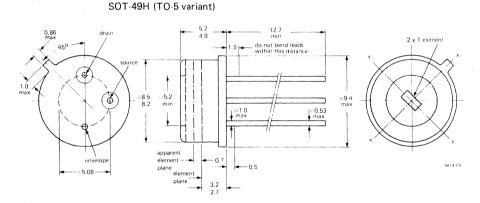
Dimensions in mm



RPY100

MECHANICAL DATA

Dimensions in mm



OBSOLESCENT TYPES

RPY93 **MECHANICAL DATA** Dimensions in mm SOT-49E (low profile TO-5) 12.7 min do not bend leads within this distance φ9.4 max φ8.5 8.2 φ5.2 φ1.0 max apparent _ element plane 0.5mm gap - 0.5 5.08 element M1816 2.6 2.3 RPY94 **MECHANICAL DATA** Dimensions in mm SOT-49E (low profile TO-5) min element A do not bend leads within this distance 1.0 max φ9.4 φ5.2 min max φ1.0 max φ0.53 max apparent _ element plane element B 1.0mm gap 0.7 - 0.5 5.08 element 2.6 2.3 RPY95 **MECHANICAL DATA** Dimensions in mm SOT-49F (low profile TO-5) 12.7 drain element A do not bend leads within this distance 1.5 1.0 max $\phi 9.4$ ϕ 4.0

> φ1.0 max

> > - 0.5

0.7

apparent _ element plane

plane

φ0.53 max

1.0mm gap

element B

5.08

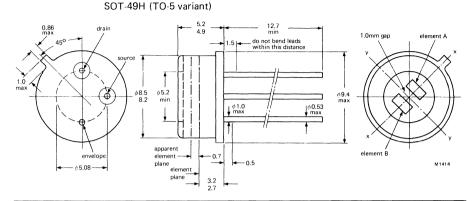
REPLACEMENT TYPES

DUAL ELEMENT PYROELECTRIC INFRARED DETECTORS

RPY103

MECHANICAL DATA

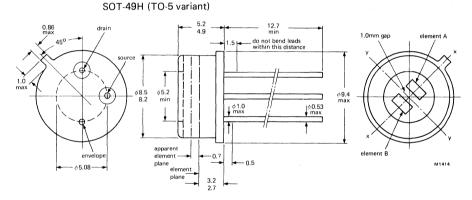
Dimensions in mm



RPY97

MECHANICAL DATA

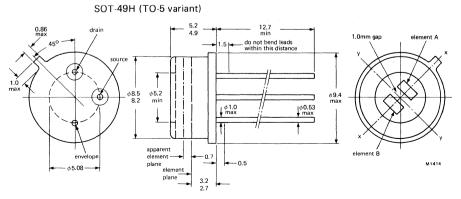
Dimensions in mm



RPY97

MECHANICAL DATA

Dimensions in mm



OBSOLESCENT TYPES

RPY86

OUICK	REFER	FNCE	DATA

Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity (10 µm, 10)	typ.	600	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	0.9 × 10 ⁻⁹	WHz ^{-1/2}
Element dimensions		2 x 1	mm
Field of View	typ.	110	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

RPY87

QUICK REFERENCE DATA

Spectral Response		1.0 to > 15	μm
Responsivity (6 μm, 10)	typ.	500	∨W ⁻¹
Noise Equivalent Power (N.E.P.) (6 μm, 10, 1)	typ.	1.05 × 10 ⁻⁹	WHz ^{-½}
Element dimensions		2 x 1	mm
Field of View	typ.	110	degrees
Operating voltage		9	V
Ontimum operating frequency range		0.1 to 1000	Hz

RPY88

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μm, 10)	typ.	300	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	1.65 × 10 ⁻⁹	WHz ^{-½}
Element dimensions		2 x 2	mm
Field of View	typ.	110	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

REPLACEMENT TYPES

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR:

RPY100

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μ m, 10)	typ.	150	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	2.5 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	20	μV
Element dimensions	nom.	2 x 1	mm
Field of View in horizontal plane (x-x)	typ.	110	degree
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

RPY107

QUICK REFERENCE DATA			
Spectral Response		1.0 to >15	μ m
Responsivity (500 K, 10)	typ.	130	VW ⁻¹
Noise Equivalent Power (N.E.P.) (500 K, 10, 1)	typ.	3.0 × 10 ⁻⁹	WHz ^{-½}
Element dimensions		2 x 1	mm
Field of View	typ.	110	degrees
Operating voltage		3	V
Optimum operating frequency range		0.1 to 20	Hz

RPY102

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μ m, 10)	typ.	75	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	5.0 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μV
Element dimensions	nom.	2 x 2	mm
Field of view in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

OBSOLESCENT TYPES

RPY89

QUICK	RE	FER	ENCE	DATA

Spectral Response		1.0 to > 15	μm
Responsivity (6 μ m, 10)	typ.	250	VW ⁻¹
Noise Equivalent Power (N.E.P.) (6 μ m, 10, 1)	typ.	2.0 × 10 ⁻⁹	WHz ^{-½}
Element dimensions		2 x 2	mm
Field of View	typ.	110	degrees
Operating voltage		9	V ,
Optimum operating frequency range		0.1 to 1000	Hz

RPY96

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μm
Responsivity, (10 μ m, 10)	typ.	130	VW ⁻¹
Noise Equivalent Power (N.E.P.), (10 μm, 10, 1)	typ.	3.5 x 10 ⁻⁹	WHz ^{-½}
Element dimensions		2 x 1	mm
Field of view	typ.	105	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

REPLACEMENT TYPES

SINGLE ELEMENT
PYROELECTRIC
INFRARED DETECTORS

RPY109

QUICK REFERENCE DATA

Spectral response		1.0 to >15	μm
Responsivity (500 K, 10)	typ.	65	VW ⁻¹
Noise Equivalent Power (N.E.P.) (500 K, 10, 1)	typ.	6.0 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	385	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μV
Element dimensions	nom.	2 x 2	mm
Field of view in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

RPY100

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μ m, 10)	typ.	150	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 μ m, 10, 1)	typ.	2.5×10^{-9}	$WHz^{-\frac{1}{2}}$
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	20	μV
Element dimensions	nom.	2 x 1	mm
Field of View in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

OBSOLESCENT TYPES

RPY93

QUICK REFERENC	E DATA	
Spectral Response		6.5 ±

0.5 to > 14μm Responsivity (10 µm, 10), each element 800 VW^{-1} typ. Noise Equivalent Power (N.E.P.), $(10 \mu m, 10, 1)$, each element 1.4×10^{-9} WHz-1/2 typ. Element dimensions, each element 2×0.75 mm Element separation 0.5 mm Field of View in horizontal plane (x-x) 120 degrees typ. V Operating voltage 9

0.1 to 1000

Hz

RPY94

QUICK REFERENCE DATA

Optimum operating frequency range

Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μ m, 10), each element	typ.	650	∨ W ⁻¹
Noise Equivalent Power (N.E.P.) (10 μ m, 10, 1), each element	typ.	1.5 x 10 ⁻⁹	WHz ^{-½}
Element dimensions, each element		2 x 1	mm
Element separation		1.0	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

RPY95

Spectral Response		$0.5 \pm 0.5 \text{ to } > 14$	μ m
Responsivity (10 μ m, 10), each element	typ.	450	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	2.1 × 10 ⁻⁹	WHz ^{-½}
Element dimensions, each element		2 x 1	mm
Element separation		1.0	mm
Field of View in horizontal plane (x-x)	typ.	110	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

REPLACEMENT TYPES

DUAL ELEMENT
PYROELECTRIC
INFRARED DETECTORS

RPY103

Spectral Response		6.5 ± 0.5 to >14	μm
Responsivity (10 μ m, 10), each element	typ.	150	VW-1
Noise Equivalent Power (N.E.P.)			
(10 μ m, 10, 1), each element	typ.	2.2×10^{-9}	WHz ^{-1/2}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μV
Element dimensions, each element	nom.	2 × 1	mm
Element separation	nom.	. 1	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz
RPY97		and the second second second second second second second second second second second second second second seco	***************************************
QUICK REFERENCE DATA			
Spectral Response	-	6.5 ± 0.5 to >14	μm
Responsivity (10 μ m, 10), each element	typ.	150	VW-1
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	2.5 × 10 ⁻⁹	WHz ^{-½}
Noise, peak-to-peak			
(bandwidth 0.5 Hz to 5 Hz)	typ.	22	μV
Element dimensions, each element	nom.	2.1×0.9	mm
Element separation	nom.	1.0	mim
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz
RPY97	,		4.4
QUICK REFERENCE DATA			
Spectral Response		6.5 ± 0.5 to >14	μινη
Responsivity (10 μ m, 10), each element	typ.	150	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	2.5 × 10 ⁻⁹	WHz ^{-1/2}
Noise, peak-to-peak			
(bandwidth 0.5 Hz to 5 Hz)	typ.	. 22	μV
Element dimensions, each element	nom.	2.1×0.9	mm
Element separation	nom.	1.0	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V ,
Optimum operating frequency range		0.1 to 20	Hz
			٠,



DUAL FLEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically intended for battery operated passive infrared movement sensors such as intruder alarms and light switches. It has differentially connected dual elements which provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise. The wide separation of the elements makes this detector compatible with most optical systems. The dual elements are combined with a single impedance converting amplifier, which is specially designed to function from low voltage supplies with low current consumption. The detector will give an output signal only when the radiation falling on the elements is unbalanced, as in a focused system. It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μ m.

QUICK REFERENCE DATA

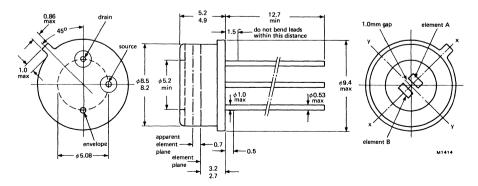
Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μm
Responsivity (10 μ m, 10), each element (see circuit 1)	typ.	150	VW ⁻¹
Responsivity (10 μm, 10), each element (see circuit 2)	typ.	720	<i>VW</i> ⁻¹
Noise Equivalent Power (N.E.P.) (10 μ m, 10, 1), each element	typ.	2.5 × 10 ⁻⁹	WHz ^{-½}
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	22	μV
Element dimensions, each element	nom.	2.1×0.9	mm
Element separation	nom.	1.0	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS—OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	٧
Temperature, operating range		-40 to +70	oC
Temperature, storage range		-55 to +85	oC
l ead soldering temperature ≥ 6 mm from header told ≤ 3 s max		+350	oC.

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of element A will produce a positive going signal at the output. For element B, the corresponding output will be negative going.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- 6. Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit 1).

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5		> 14	μ m
Responsivity* (10 μ m, 10)	note 1	95	150		VW-1
Responsivity (10 μm, 10)	note 5	_	<i>720</i>	_	VW^{-1}
N.E.P. (10 μm, 10, 1)	note 1	_	2.5×10^{-9}	-	WHz ^{-½}
Element matching*	note 2	_	_	± 20	%
Noise*, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	note 4		22	50	μV
Field of View (x-x plane, total angle)	note 3	_	130		degrees
Quiescent current		_	10	_	μΑ
Element dimensions		2.1	\times 0.9 nominal		mm
Element separation			1.0 nominal		mm

^{*}These parameters are 100% tested with statistical sample quality inspection.

FET Characteristics (at T_{amb} = 22 °C ± 3 °C)

		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{(P)GS}	-1.2	-	-0.5	V
Transfer Conductance $V_{GS} = 0$, $V_{DS} = 6 V$, $f = 1.0 kHz$	9fso	1.3	_	_	mAV ⁻¹

Notes

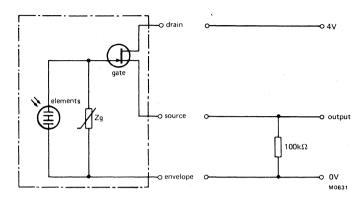
- 1. Each element. These characteristics apply throughout the spectral response range.
- 2. With both elements irradiated, the matching of the element signals is derived from:-

$$\frac{\Delta S}{\mbox{$\%$} (S_A + S_B)}$$
 $\mbox{$\times$}$ 100, where S_A and S_B are the signals of the two elements and ΔS is the signal

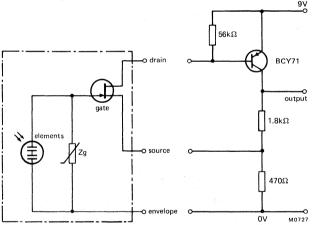
with both elements irradiated.

- 3. Field of view to 50% of the maximum signal level.
- 4. Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 5. The RPY97 has been specified in conjunction with a source follower circuit with a typical gain of 0.9. For comparison with the older type dual element detectors, the alternative circuit shown on page 4 should be used. This explains the difference in responsivity levels.

CIRCUIT 1 (RECOMMENDED)



CIRCUIT 2 (ALTERNATIVE, x 5 GAIN)



DEFINITIONS

- 1. Responsivity VW-1
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (10 μ m, 10). The 10 μ m denotes the wavelength of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- Noise Equivalent Power (N.E.P.) WHz^{-1/2}
 This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s.

signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz^{-1/2}. As with responsivity the relevant test conditions must be specified, for example (10 μ m, 10, 1). The 10 μ m is the wavelength of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

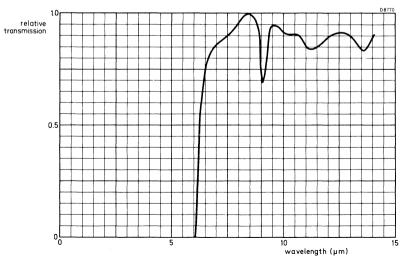
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

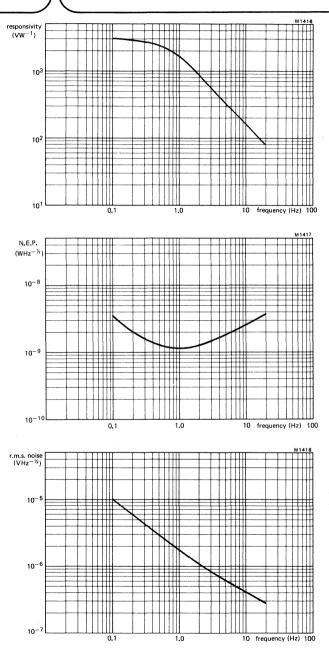
		Test		Severity	Duration	Note
IEC	68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
	68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
	68-2-21	Ub	Lead Fatigue	4 cycles		1
	68-2-1	Aa	Low Temperature Storage	−55 °C	2000 hours	2
	68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
	68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
	68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
	68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
	68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
	68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

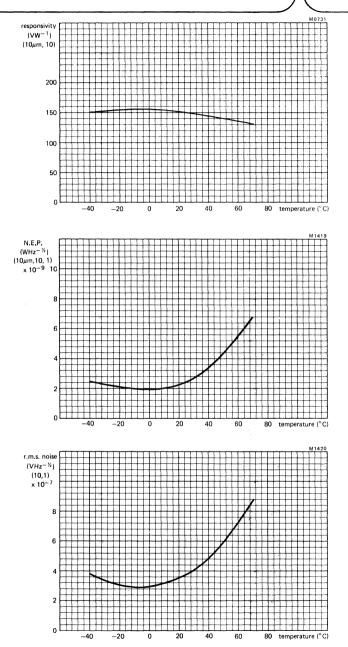
- 1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



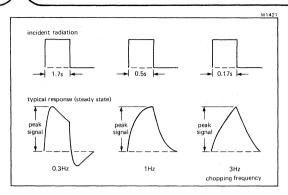
Typical normalized window transmission characteristic



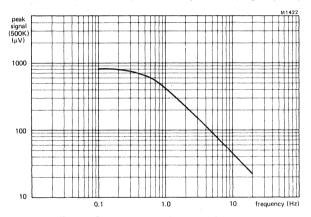
Typical Responsivity, N.E.P., and r.m.s. Noise as functions of Frequency, using recommended circuit 1 (one element screened).



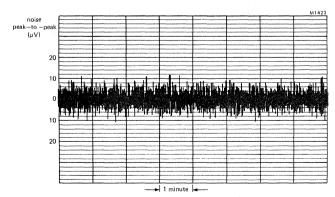
Typical Responsivity, N.E.P., and Noise as functions of Temperature, using recommended circuit 1 (one element screened).



Typical response (steady state) for a given chopping frequency

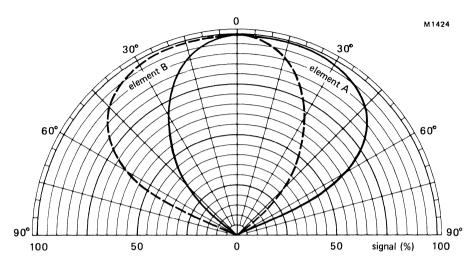


Typical Peak Signal as a function of Frequency (energy level 25 $\mu W cm^{-2}$ at the detector and one element screened)

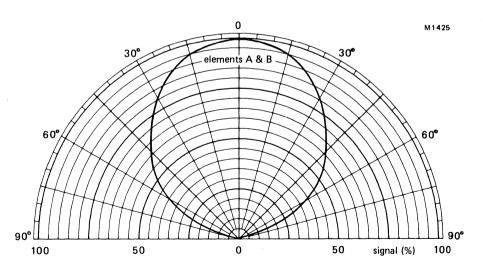


Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)



SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device intended for battery operated passive infrared movement sensors such as intruder alarms in which high grade optics e.g. multi-faceted mirrors or Fresnel lenses are used. The element is combined with a single impedance converting amplifier which is specially designed to function from low voltage supplies with low current consumption. The detector is sealed in a low profile TO-5 can with a window optically coated to restrict response to wavelengths greater than $6.5~\mu m$.

QUICK REFERENCE DATA

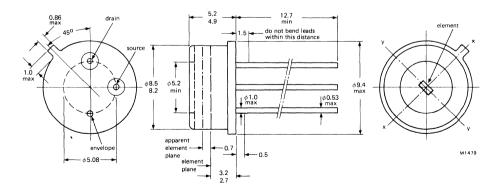
Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μ m
Responsivity (10 μ m, 10)	typ.	150	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	2.5 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	20	μV
Element dimensions	nom.	2 x 1	mm
Field of View in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	V
Temperature, operating range		-40 to +70	οС
Temperature, storage range		-55 to +85	oC
Lead soldering temperature, \geq 6 mm from header, $t_{sld} \leq 3$ s max.		+350	oC

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	_	>14	μm
Responsivity* (10 μ m, 10)		95	150	_	VW ⁻¹
N.E.P. (10 μm, 10, 1)			2.5 x 10 ⁻⁹	_	$WHz^{-\frac{1}{2}}$
Peak signal (500 K, 1)	note 1	_	460	_	μV
Noise*, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	note 2		20	45	μV
Field of View (x-x plane, total angle)	note 3	90	110		degrees
(y-y plane, total angle)	note 3	90	110	_	degrees
Quiescent current		_	10		μΑ
Element dimensions		2	x 1 nominal		mm

^{*}These parameters are 100% tested with statistical sample quality inspection.

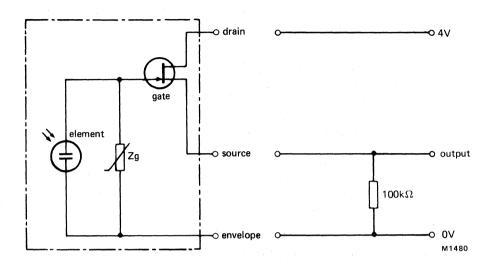
FET Characteristics (at $T_{amb} = 22 \, {}^{o}C \pm 3 \, {}^{o}C$)

		min.	typ.	max.	
Gate-Source Cut-off Voltage				t.	
$I_D = 0.1 \mu\text{A}, V_{DS} = 6 \text{V}$	$V_{P(GS)}$	 1.2	_	-0.5	V
Transfer Conductance					
$V_{GS} = 0$, $V_{DS} = 6 \text{ V}$, $f = 1 \text{ kHz}$	9fso.	1.3			mAV ⁻¹

Notes

- 1. At an energy level of 25 μ Wcm⁻² at the detector.
- 2. Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 3. Field of view to 50% of the maximum signal level.

RECOMMENDED CIRCUIT



DEFINITIONS

- Responsivity VW⁻¹
 This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example
 - power. The published values of responsivity are qualified by figures in brackets, for example (10 μ m, 10). The 10 μ m denotes the wavelength of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
 - 2. Noise Equivalent Power (N.E.P.) WHz-½
 This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz-½. As with responsivity the relevant test conditions must be specified, for example (10 μm, 10, 1). The 10 μm is the wavelength of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

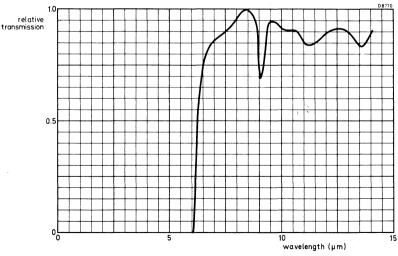
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

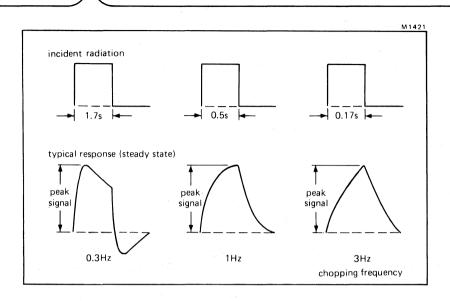
		Test		Severity	Duration	Note
IEC	68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
	68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
	68-2-21	Ub	Lead Fatigue	4 cycles	_	1
	68-2-1	Aa	Low Temperature Storage	_55 oC	2000 hours	2
	68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
	68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
	68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
	68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
	68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
	68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

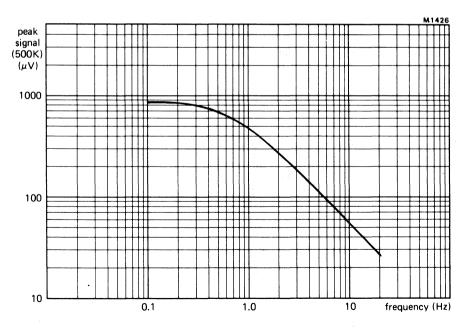
- 1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



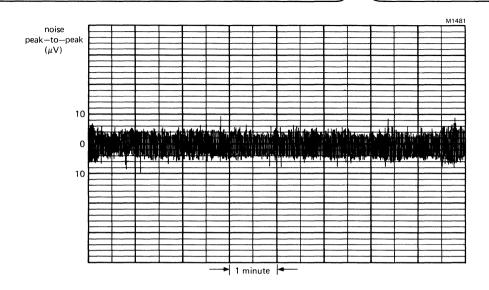
Typical normalized window transmission characteristic



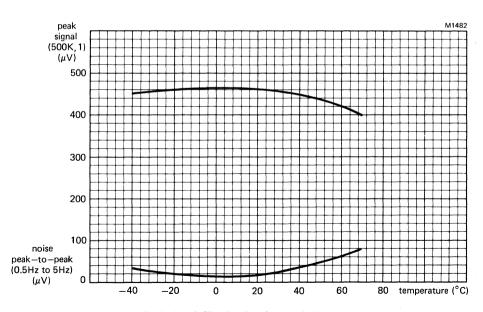
Typical response (steady state) for a given chopping frequency



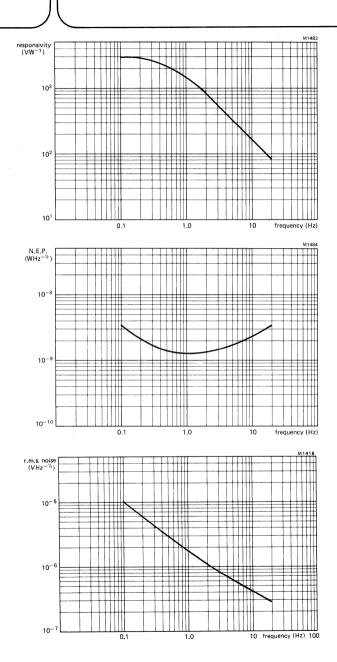
Typical peak Signal as a function of Frequency (energy level 25 $\mu W cm^{-2}$ at the detector)



Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)

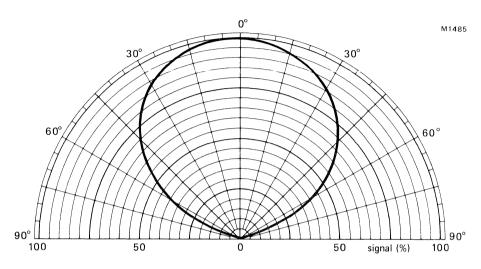


Typical peak Signal and peak-to-peak Noise as functions of Temperature (peak Signal energy level, 25 μ Wcm⁻² at the detector)

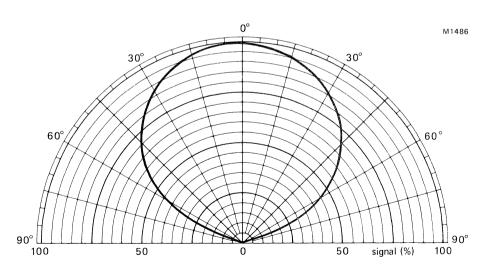


Typical Responsivity, N.E.P., and r.m.s. Noise as functions of Frequency, using recommended circuit.

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device intended for battery operated passive infrared movement sensors such as intruder alarms in which medium grade optics are used. The element is combined with a single impedance converting amplifier which is specially designed to function from low voltage supplies with low current consumption. The detector is sealed in a low profile TO-5 can with a window optically coated to restrict response to wavelengths greater than $6.5 \ \mu m$.

QUICK REFERENCE DATA

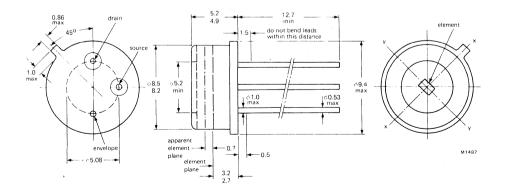
Spectral Response		6.5 ± 0.5 to >14	μm
Responsivity (10 μm, 10)	typ.	150	VW^{-1}
Noise Equivalent Power (N.E.P.) (10 μ m, 10, 1)	typ.	3.8 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	18	μV
Element dimensions	nom.	2 x 1.5	mm
Field of View in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49H (TO-5 variant)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	V
Temperature, operating range		-40 to +70	oC
Temperature, storage range		-55 to +85	oC
Lead soldering temperature, \geq 6 mm from header, $t_{sld} \leq 3$ s max.		+350	oC

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5		>14	μm
Responsivity* (10 μ m, 10)		65	100	_	VW ⁻¹
N.E.P. (10 μm, 10, 1)		_	3.8×10^{-9}	_	WHz ⁻¹
Peak signal (500 K, 1)	note 1	_	460	_	μV
Noise*, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	note 2	_	18	45	μV
Field of View (x-x plane, total angle)	note 3	90	110		degrees
(y-y plane, total angle)	note 3	90	110	_	degrees
Quiescent current			10		μΑ
Element dimensions		2	x 1.5 nominal		mm

^{*}These parameters are 100% tested with statistical sample quality inspection.

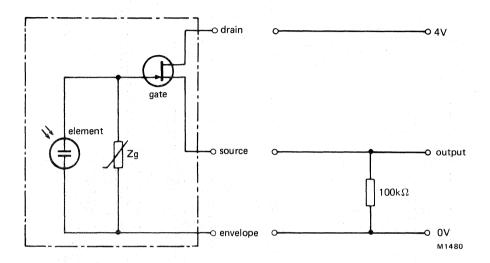
FET Characteristics (at T_{amb} = 22 ${}^{o}C \pm 3 {}^{o}C$)

		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{P(GS)}	-1.2	-	-0.5	٧
Transfer Conductance $V_{GS} = 0$, $V_{DS} = 6$ V, $f = 1$ kHz	gfso	1.3	-		mAV ⁻¹

Notes

- 1. At an energy level of 25 μ Wcm⁻² at the detector.
- 2. Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 3. Field of view to 50% of the maximum signal level.

RECOMMENDED CIRCUIT



DEFINITIONS

- 1. Responsivity VW-1
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (10 µm, 10). The 10 µm denotes the wavelength of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- 2. Noise Equivalent Power (N.E.P.) WHz-1/2

This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz^{- $\frac{1}{2}$}. As with responsivity the relevant test conditions must be specified, for example (10 μ m, 10, 1). The 10 μ m is the wavelength of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

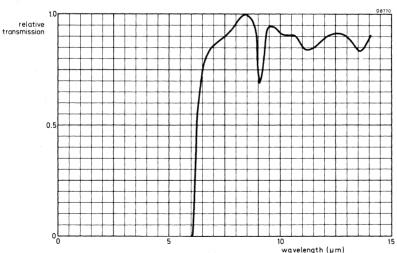
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

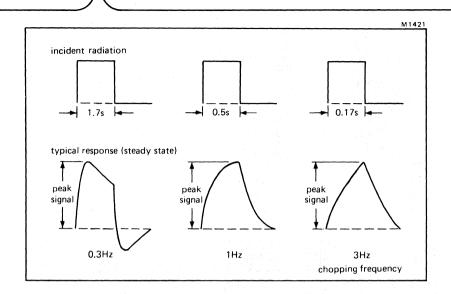
	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	_	1
68-2-1	Aa	Low Temperature Storage	_55 °C	2000 hours	2
68-2-2	Ва	High Temperature Storage	+85 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	−55 °C to +85 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

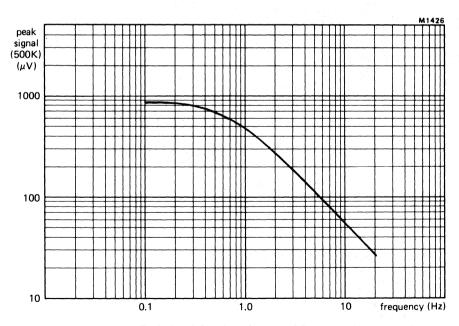
- 1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



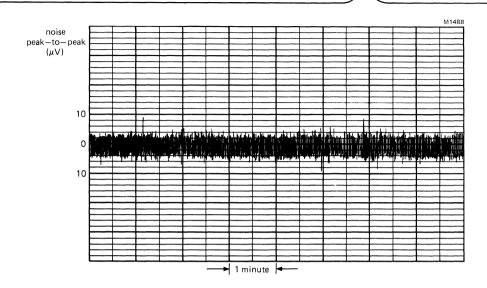
Typical normalized window transmission characteristic



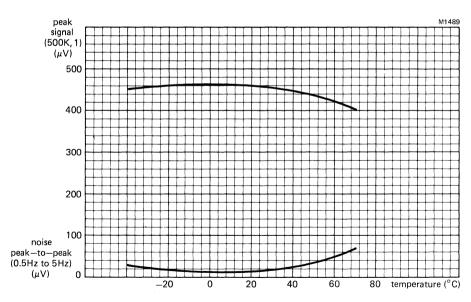
Typical response (steady state) for a given chopping frequency



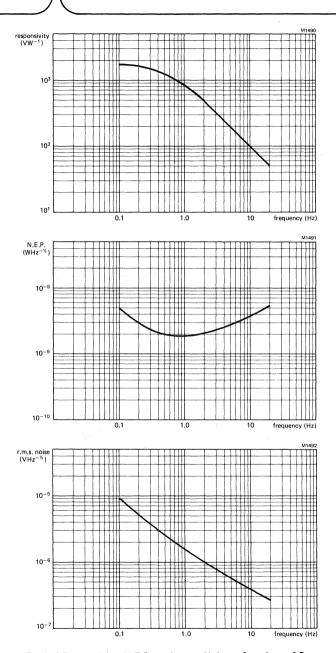
Typical peak Signal as a function of Frequency (energy level 25 μ Wcm⁻² at the detector)



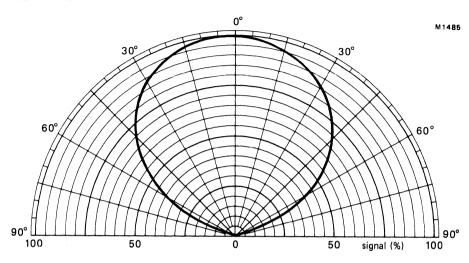
Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)



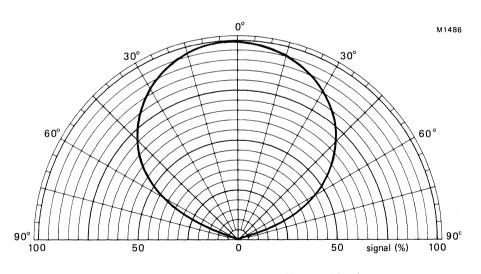
Typical peak Signal and peak-to-peak Noise as functions of Temperature (peak Signal energy level, 25 $\mu \rm Wcm^{-2}$ at the detector)



Typical Responsivity, N.E.P., and r.m.s. Noise as functions of Frequency, using recommended circuit.



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)



SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device intended for battery operated passive infrared movement sensors such as intruder alarms and light switches which use low grade or no optical focusing arrangements. The element is combined with a single impedance converting amplifier which is specially designed to function from low voltage supplies with low current consumption. The detector is sealed in a low profile TO-5 can with a window optically coated to restrict response to wavelengths greater than $6.5 \ \mu m$.

QUICK REFERENCE DATA

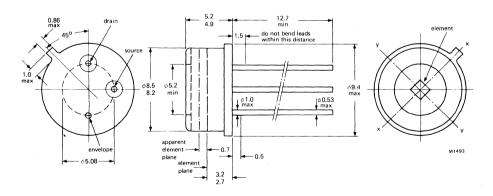
Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μm
Responsivity (10 μ m, 10)	typ.	75	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 µm, 10, 1)	typ.	5.0 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μV
Element dimensions	nom.	2 x 2	mm
Field of view in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49H (TO-5 variant)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	٧
Temperature, operating range		-40 to +70	oC
Temperature, storage range		-55 to +85	oC
Lead soldering temperature, \geq 6 mm from header, $t_{sld} \leq 3$ s max.		+350	oC

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- 6. Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	_	>14	μ m
Responsivity* (10 μ m, 10)		50	75	-	VW ⁻¹
N.E.P. (10 μm, 10, 1)		_	5.0×10^{-9}	-	WHz ⁻¹
Peak signal (500 K, 1)	note 1	_	460	_	μV
Noise*, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	note 2		15	45	μV
Field of View (x-x plane, total angle)	note 3	90	110	_	degrees
(y-y plane, total angle)	note 3	90	110	_	degrees
Quiescent current			10	_	μΑ
Element dimensions		2	x 2 nominal		mm

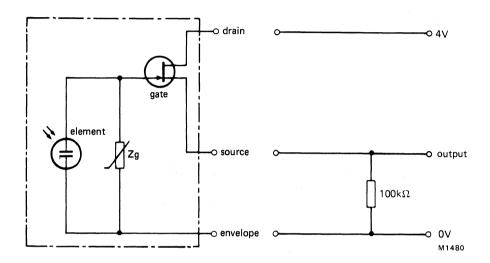
^{*}These parameters are 100% tested with statistical sample quality inspection.

FET Characteristics (at T_{amb} = 22 °C ± 3 °C)

		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A, V_{DS} = 6 V$	V _{P(GS)}	-1.2		-0.5	V
Transfer Conductance VGS = 0, VDS = 6 V, f = 1 kHz	gfso	1.3	_	_	mAV ⁻¹

- 1. At an energy level of 25 μ Wcm⁻² at the detector.
- 2. Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 3. Field of view to 50% of the maximum signal level.

RECOMMENDED CIRCUIT



DEFINITIONS

- 1. Responsivity VW-1
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (10 μm , 10). The 10 μm denotes the wavelength of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- 2. Noise Equivalent Power (N.E.P.) WHz-1/2

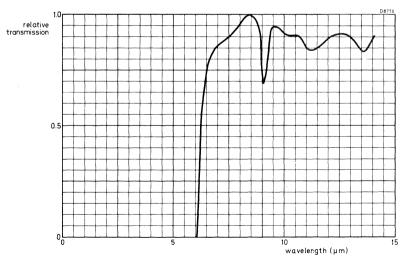
This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-\frac{1}{2}}$. As with responsivity the relevant test conditions must be specified, for example (10 μ m, 10, 1). The 10 μ m is the wavelength of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

MECHANICAL AND ENVIRONMENTAL STANDARDS

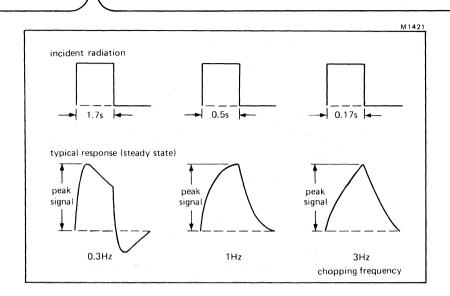
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	_	1
68-2-1	Aa	Low Temperature Storage	−55 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 ^o C, 6 mm from header	3 seconds	3

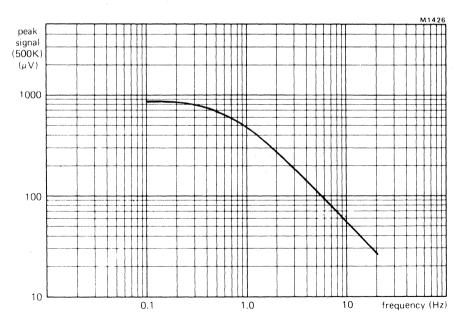
- 1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



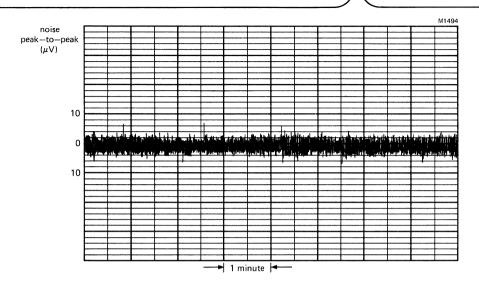
Typical normalized window transmission characteristic



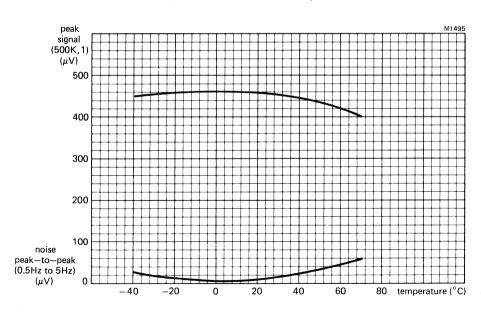
Typical response (steady state) for a given chopping frequency



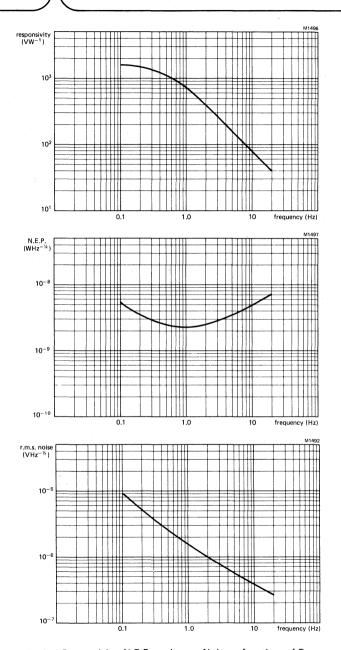
Typical peak Signal as a function of Frequency (energy level 25 μ Wcm⁻² at the detector)



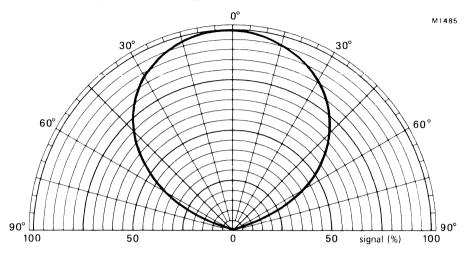
Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)



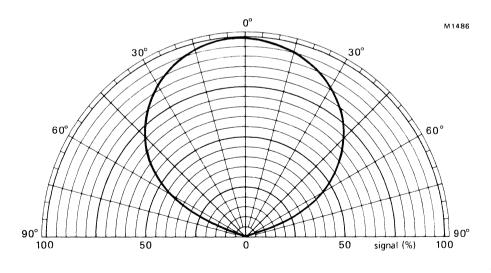
Typical peak Signal and peak-to-peak Noise as functions of Temperature (peak Signal energy level, $25~\mu \text{Wcm}^{-2}$ at the detector)



Typical Responsivity, N.E.P., and r.m.s. Noise as functions of Frequency, using recommended circuit.



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

DUAL ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically intended for battery operated passive infrared movement sensors, such as intruder alarms. It has differentially connected dual elements specially designed to give improved noise and transient spike performance at elevated temperatures. The wide separation of the elements makes this detector compatible with most optical systems. The dual elements are combined with a single impedance converting amplifier which is designed to operate from low voltage supplies with low current consumption. The detector will give an output signal only when the radiation falling on the elements is unbalanced, as in a focused system. It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μ m.

QUICK REFERENCE DATA

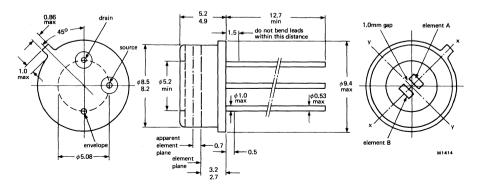
QUICK REFERENCE DATA			
Spectral Response		$6.5 \pm 0.5 \text{ to} > 14$	μm
Responsivity (10 μ m, 10), each element	typ.	150	VW ⁻¹
Noise Equivalent Power (N.E.P.) (10 μ m, 10, 1), each element	typ.	2.2 × 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1)	typ.	460	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μV
Element dimensions, each element	nom.	2 × 1	mm
Element separation	nom.	1	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	V
Temperature, operating range		-20 to +50	oC
Temperature, storage range		-55 to +85	oC
Lead soldering temperature. \geq 6 mm from header, $t_{eld} \leq 3$ s max.		+350	οС

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of element A will produce a positive going signal at the output. For element B, the corresponding output will be negative going.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 o C \pm 3 o C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	_	> 14	μ m
Responsivity* (10 μ m, 10)	note 1	95	150		VW ⁻¹
N.E.P. (10 μm, 10, 1)	note 1		2.2×10^{-9}		$WHz^{-\frac{1}{2}}$
Element matching* (10 μ m, 10)	note 2	-		± 20	%
Peak signal (500 K, 1)	note 5	_	460	-	μV
Noise*, peak-to-peak					
(bandwidth 0.5 Hz to 5 Hz)	note 4	_	15	45	μV
Element matching (10 μ m, 1)	note 2	_		± 20	%
Field of View (x-x plane, total angle)	note 3	100	130	_	degrees
(y-y plane, total angle)	note 3	85			degrees
Quiescent current		_	10	_	μΑ
Element dimensions		. 2	2 × 1 nominal		mm
Element separation			1 nominal		mm

^{*}These parameters are 100% tested with statistical sample quality inspection.

FET Characteristics (at T_{amb} = 22 °C ± 3 °C)

		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{P(GS)}	-1.2	_	-0.5	V
Transfer Conductance $V_{GS} = 0$, $V_{DS} = 6$ V, $f = 1$ kHz	9fso	1.3	_	_	mAV ⁻¹

Notes

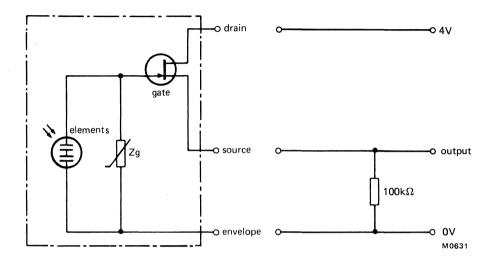
- 1. Each element. These characteristics apply throughout the spectral response range.
- 2. With both elements irradiated, the matching of the element signals is derived from:-

$$\frac{\Delta S}{\frac{1}{2} (S_A + S_B)}$$
 \times 100, where S_A and S_B are the signals of the two elements and ΔS is the signal

with both elements irradiated.

- 3. Field of view to 50% of the maximum signal level.
- 4. Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 5. At an energy level of 25 μ Wcm⁻² at the detector.

RECOMMENDED CIRCUIT



DEFINITIONS

- 1. Responsivity VW-1
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (10 μ m, 10). The 10 μ m denotes the wavelength of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- 2. Noise Equivalent Power (N.E.P.) WHz-1/2

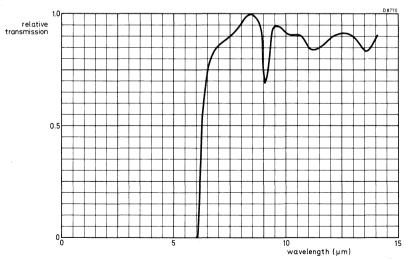
This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz^{- $\frac{1}{2}$}. As with responsivity the relevant test conditions must be specified, for example (10 μ m, 10, 1). The 10 μ m is the wavelength of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

MECHANICAL AND ENVIRONMENTAL STANDARDS

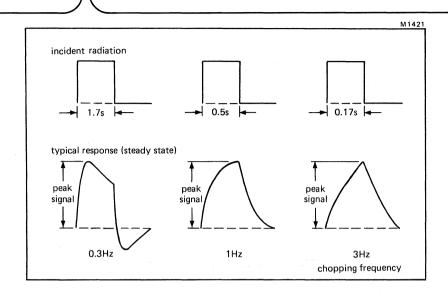
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	_	1
68-2-1	Aa	Low Temperature Storage	−55 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

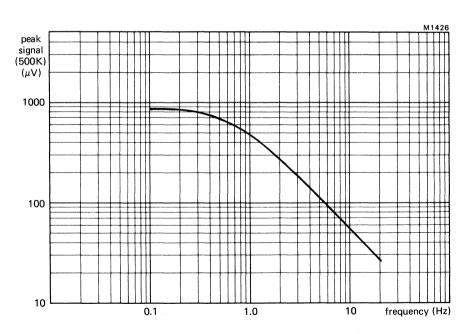
- 1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check



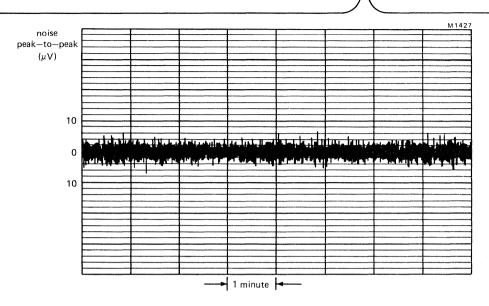
Typical normalized window transmission characteristic



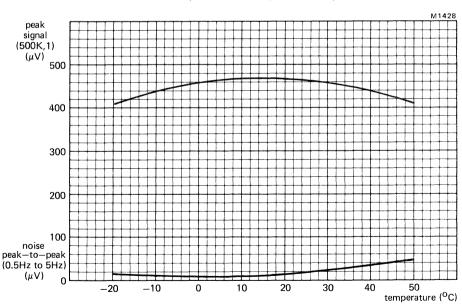
Typical response (steady state) for a given chopping frequency



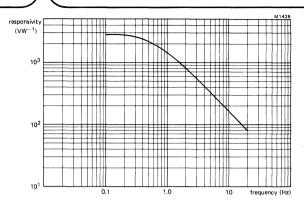
Typical Peak Signal as a function of Frequency (energy level 25 μ Wcm⁻² at the detector and one element screened)



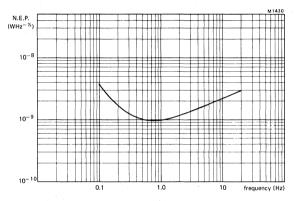
Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)



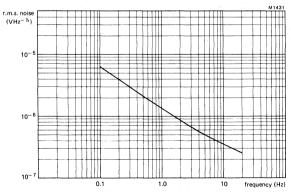
Typical peak Signal and peak-to-peak Noise as functions of Temperature (peak Signal energy level 25 μ Wcm⁻² at the detector, one element screened)



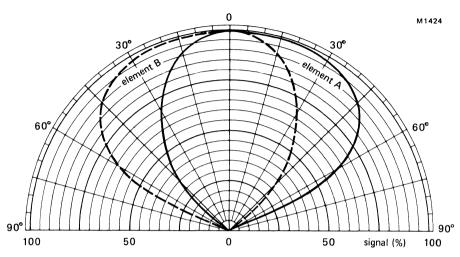
Typical Responsivity as a function of Frequency (one element screened)



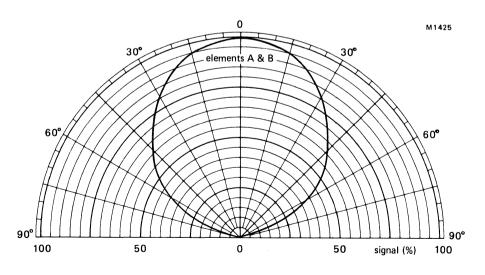
Typical N.E.P. as a function of Frequency (one element screened)



Typical r.m.s. Noise as a function of Frequency (one element screened)



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)



SINGLE ELEMENT PYROELECTRIC INFRARED SENSOR

This is an infrared sensitive device incorporating a single impedance converting amplifier which is specially designed to function from low voltage supplies with low current consumption. The sensor is sealed in a low profile TO-5 can with an uncoated silicon window.

QUICK REFERENCE DATA

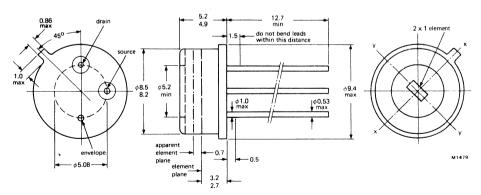
Spectral response		1.0 to >15	μm
Responsivity (500 K, 10)	typ.	130	VW ⁻¹
Noise Equivalent Power (N.E.P.)	٠, ٢,	100	•••
(500 K, 10, 1)	typ.	3.0×10^{-9}	WHz ^{-½}
Peak signal (500 K, 1) see characteristics, note 1	typ.	385	μ ∨
Noise, peak-to-peak (bandwidth 0.4 Hz to 5 Hz)	typ.	20	μV
Element dimensions	nom.	2 x 1	mm
Field of view in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	V
Temperature, operating range		-40 to +70	oC .
Temperature, storage range		-55 to +85	οС
Lead soldering temperature, \geqslant 6 mm from header, $t_{sld} \le 3$ s		+350	οС

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the sensor at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the sensor must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The sensor will operate outside the quoted range but may have a degraded performance.
- Before testing, due to the high sensitivity of these sensors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral response		1.0	_	>15	μm
Responsivity* (500 K, 10)		90	130		VW ⁻¹
N.E.P. (500 K, 10, 1)		_	3.0×10^{-9}	_	WHz ⁻¹
Peak signal (500 K, 1)	note 1		385	_	μV
Noise*, peak-to-peak (bandwidth 0.4 Hz to 5 Hz)	note 2	_	20	45	μV
Field of view (x-x plane, total angle)	note 3	90	110		degrees
(y-y plane, total angle)	note 3	90	110	-	degrees
Quiescent current			10		μΑ
Element dimensions			2 x 1 nominal		mm

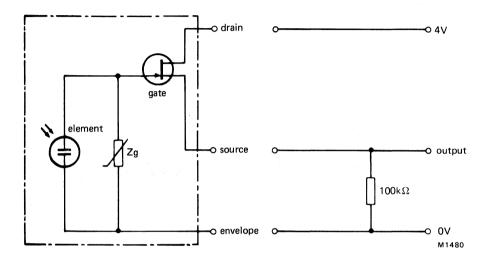
^{*}These parameters are 100% tested with statistical sample quality inspection.

FET characteristics (at T_{amb} = 22 °C ± 3 °C)

		min.	typ.	max.	
Gate-source cut-off voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{P(GS)}	-1.2	_	-0.5	V
Transfer conductance $V_{GS} = 0$, $V_{DS} = 6$ V, $f = 1$ kHz	9fso	1.3	_	_	mAV ⁻¹

- 1. At any energy level of 25 μ Wcm⁻² at the sensor.
- 2. Using low noise filter with 3 dB bandwidth (0.4 to 5 Hz) and roll off at 12 dB per octave. Sensors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 3. Field of view to 50% of the maximum signal level.

RECOMMENDED CIRCUIT



DEFINITIONS

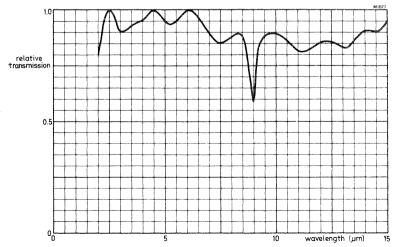
- 1. Responsivity VW⁻¹
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (500 K, 10). The 500 K denotes the temperature of the black body source of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- 2. Noise Equivalent Power (N.E.P.) WHz^{-1/2}
 This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz^{-1/2}. As with responsivity the relevant test conditions must be specified, for example (500 K, 10, 1). The 500 K is the temperature of the black body source of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

MECHANICAL AND ENVIRONMENTAL STANDARDS

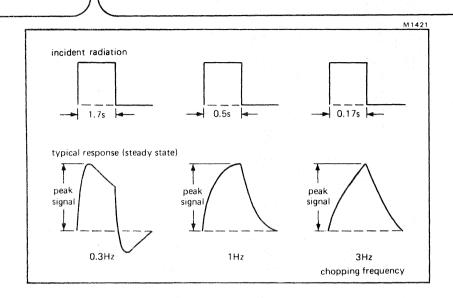
As part of the Quality Assurance programme, the sensors will be assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles		1
68-2-1	Aa	Low Temperature Storage	-55 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

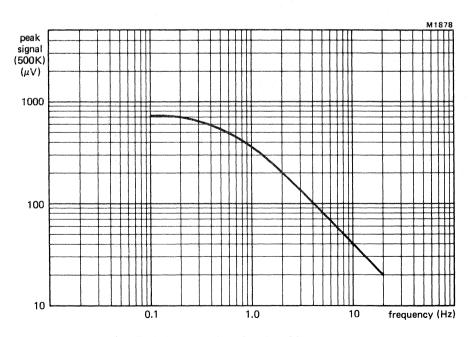
- 1. The sensors to be checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The sensors to be checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



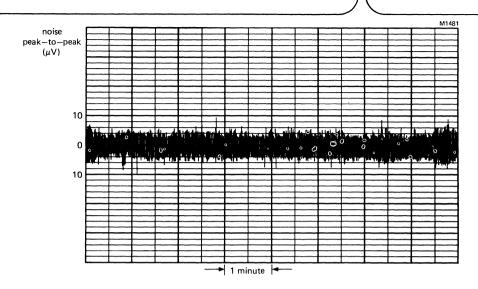
Typical normalized window transmission characteristic



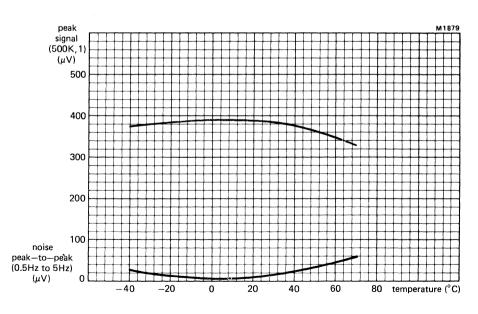
Typical response (steady state) for a given chopping frequency



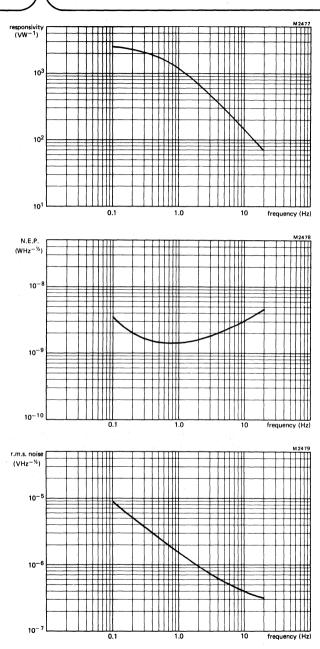
Typical peak signal as a function of frequency (energy level 25 μ Wcm⁻² at the sensor)



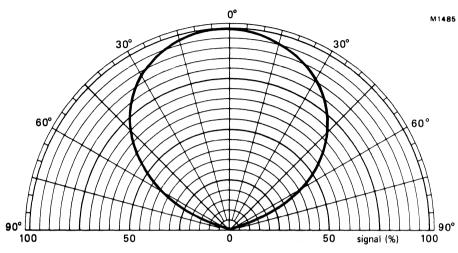
Typical peak-to-peak noise as a function of time (filter bandwidth 0.5 Hz to 5 Hz)



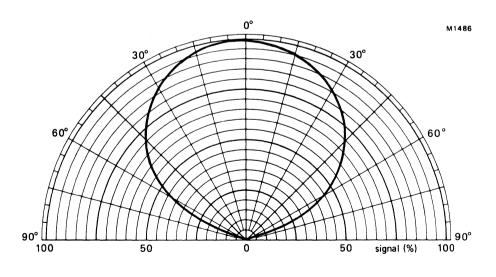
Typical peak signal and peak-to-peak noise as functions of temperature (peak signal energy level, 25 µWcm⁻² at the sensor)



Typical responsivity, N.E.P., and r.m.s. noise as functions of frequency using recommended circuit.



Typical field of view in x-x plane (see Mechanical data)



Typical field of view in y-y plane (see Mechanical Data)



DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device incorporating a single impedance converting amplifier which is specially designed to function from low voltage supplies with low current consumption. The detector is sealed in a low profile TO-5 can with an uncoated silicon window.

QUICK REFERENCE DATA

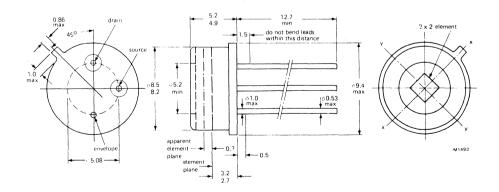
Spectral response		1.0 to >15	μm
Responsivity (500 K, 10)	typ.	65	VW ⁻¹
Noise Equivalent Power (N.E.P.) (500 K, 10, 1)	typ.	6.0 x 10 ⁻⁹	WHz ^{-½}
Peak signal (500 K, 1) see characteristics, note 1	typ.	385	μV
Noise, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	typ.	15	μ∨
Element dimensions	nom.	2 x 2	mm
Field of view in horizontal plane (x-x)	typ.	110	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49H (TO-5 variant)

Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. In the United Kindom disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	٧
Temperature, operating range		-40 to +70	oC
Temperature, storage range		-55 to +85	oC
Lead soldering temperature ≥ 6 mm from header total ≤ 3 s max		+350	°C

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	0.1	20	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at Tamb = 22 °C ± 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		1.0	_	>15	μm
Responsivity* (500 K, 10)		45	65	_	VW ⁻¹
N.E.P. (500 K, 10, 1)		_	6.0×10^{-9}	_	WHz ⁻¹
Peak signal (500 K, 1)	note 1	_	385	_	μV
Noise*, peak-to-peak (bandwidth 0.5 Hz to 5 Hz)	note 2	_	15	45	μV
Field of View (x-x plane, total angle)	note 3	90	110	_	degrees
(y-y plane, total angle)	note 3	90	110	_	degrees
Quiescent current			10	_	μA
Element dimensions			2 x 2 nominal		mm

^{*}These parameters are 100% tested with statistical sample quality inspection.

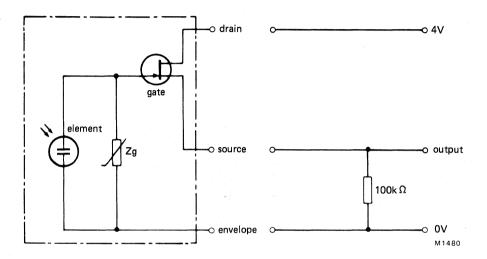
FET Characteristics (at T_{amb} = 22 °C ± 3 °C)

		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{P(GS)}	-1.2	_	-0.5	٧
Transfer Conductance V _{GS} = 0, V _{DS} = 6 V, f = 1 kHz	9fso	1.3	_	_	mAV ⁻¹

Notes

- 1. At an energy level of 25 $\mu \text{Wcm}^{\text{-}2}$ at the detector.
- Using low noise filter with 3 dB bandwidth and roll off at 12 dB per octave. Detectors tested for 1 minute under stable electrical and thermal conditions; see operating note 6.
- 3. Field of view to 50% of the maximum signal level.

RECOMMENDED CIRCUIT



DEFINITIONS

- 1. Responsivity VW⁻¹
 - This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (500 K, 10). The 500 K denotes the temperature of the black body source of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.
- 2. Noise Equivalent Power (N.E.P.) WHz^{-1/2}
 This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth VHz^{-1/2}. As with responsivity the relevant test conditions must be specified, for example (500 K, 10, 1). The 500 K is the temperature of the black body source of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

MECHANICAL AND ENVIRONMENTAL STANDARDS

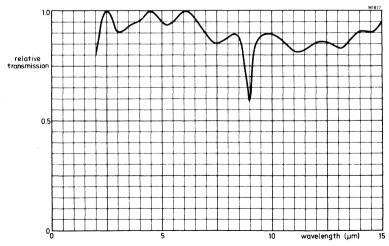
As part of the Quality Assurance programme, the detectors will be assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

		Test		Severity	Duration	Note
IEC	68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
	68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
	68-2-21	Ub	Lead Fatigue	4 cycles	_	1
	68-2-1	Aa	Low Temperature Storage	−55 °C	2000 hours	2
	68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
	68-2-14	Nb	Change of Temperature	-55 °C to +85 °C	10 cycles	2
	68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation	2
	68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds	2
	68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations	2
	68-2-20	Ть	Resistance to Solder Heat	+350 ^O C, 6 mm from header	3 seconds	3

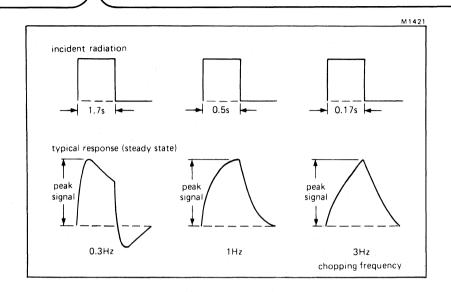
Notes

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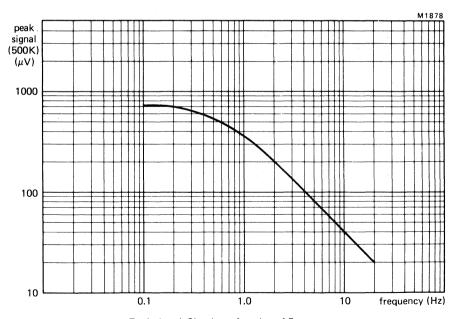
- 1. The detectors to be checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
- 2. The detectors to be checked at quarterly intervals. This is equivalent to Group C.
- 3. This is an annual check.



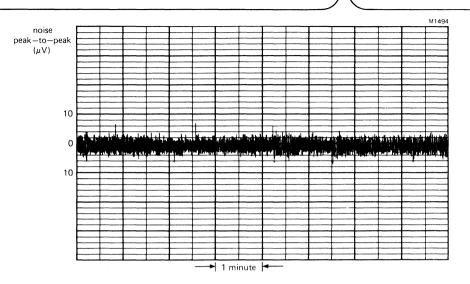
Typical normalized window transmission characteristic



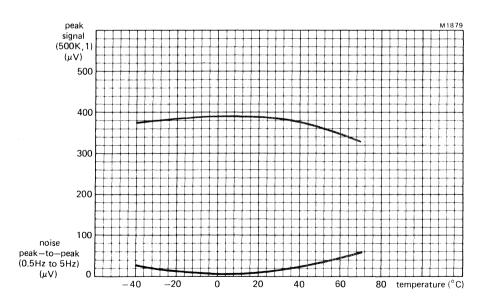
Typical response (steady state) for a given chopping frequency



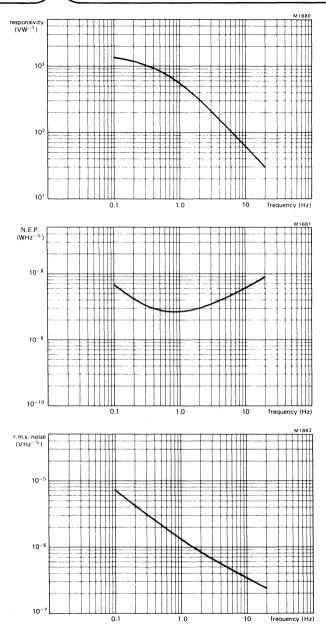
Typical peak Signal as a function of Frequency (energy level 25 $\mu W cm^{-2}$ at the detector)



Typical peak-to-peak Noise as a function of Time (filter bandwidth 0.5 Hz to 5 Hz)

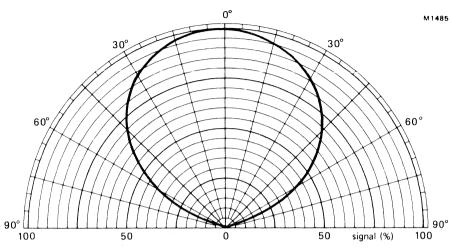


Typical peak Signal and peak-to-peak Noise as functions of Temperature (peak Signal energy level, $25~\mu \text{Wcm}^{-2}$ at the detector)

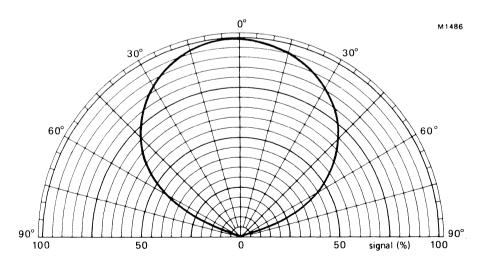


Typical Responsivity, N.E.P., and r.m.s. Noise as functions of Frequency, using recommended circuit.

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)



This data sheet contains advance information and specifications are subject to change without notice.

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device intended for gas analysis systems such as that used for analysing car exhausts. The element is combined with a single impedance converting amplifier which is specially designed to operate from low voltage supplies with low current consumption. The detector is sealed in a 3-lead TO-5 encapsulation modified to incorporate a potassium bromide (KBr) window.

QUICK REFERENCE DATA

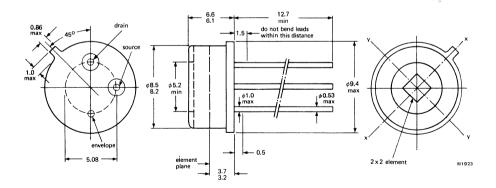
Spectral Response		1 to 25	μm
Responsivity (500 K, 10)	typ.	90	∨W -1
Noise Equivalent Power (N.E.P.) (500 K, 10, 1)	typ.	1.4 x 10 ⁻⁹	WHz ^{-½}
D* (500 K, 10, 1)	typ.	1.4×10^{8}	cmHz½W-1
Element dimensions	nom.	2 x 2	mm
Field of view in horizontal plane (x-x)	min.	60	degrees
Operating voltage	min.	3	V , ,
Optimum operating frequency range		10 to 100	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49G (TO-5 variant)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

- 1. When making soldered connections to the leads, a thermal shunt should be used.
- It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	30	V
Temperature, operating range		-20 to +70	oC
Temperature, storage range		-20 to +70	οС
Lead soldering temperature ≥ 6 mm from header total ≤ 3 s max.		+350	oC.

OPERATING CONDITIONS

	min.	max.	
Voltage (operating note 5)	3	10	V
Frequency (operating note 5)	10	100	Hz

OPERATING NOTES

- The case potential must not be allowed to become positive with respect to the other two terminals.
- 2. It is inadvisable to operate the detector at mains related frequencies.
- 3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
- 4. An increase in temperature of the element will produce a positive going signal at the output.
- 5. The detector will operate outside the quoted range but may have a degraded performance.
- 6. Before testing, due to the high sensitivity of these detectors, care must be taken to ensure that the devices are allowed to become thermally stable.

CHARACTERISTICS (at T_{amb} = 22 °C \pm 3 °C and with recommended circuit)

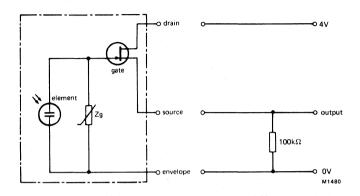
		min.	typ.	max.	
Spectral Response		1.0	-	25	μm
Responsivity (500 K, 10)		60	90	_	VW^{-1}
N.E.P. (500 K, 10, 1)		_	1.4 x 10 ⁻⁹	3 x 10 ⁻⁹	WHz ⁻¹
D* (500 K, 10, 1)			1.4×10^{8}		cmHz½W-1
Field of View (x-x plane, total angle) (y-y plane, total angle)	note 1 note 1	60 60	_	_	degrees degrees
Quiescent current		_	10	_	μΑ
Element dimensions			2 x 2 nominal		mm
FET Characteristics (at T _{amb} = 22 °C :	± 3 °C)				
		min.	typ.	max.	
Gate-Source Cut-off Voltage $I_D = 0.1 \mu A$, $V_{DS} = 6 V$	V _{P(GS)}	-1.2	_	-0.5	V
Transfer Conductance VGS = 0, VDS = 6 V, f = 1 kHz	9fso	1.3	. -		mAV ⁻¹

latas

1. Field of view to 50% of the maximum signal level.

P2105 (DEV. NO)

RECOMMENDED CIRCUIT



DEFINITIONS

1. Responsivity VW⁻¹

This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power. The published values of responsivity are qualified by figures in brackets, for example (500 K, 10). The 500 K denotes the temperature of the black body source of the infrared radiation generating the signal voltage, while the 10 indicates that the radiation is chopped at a frequency of 10 Hz.

2. Noise Equivalent Power (N.E.P.) WHz-1/2

This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-\frac{1}{2}}$. As with responsivity the relevant test conditions must be specified, for example (500 K, 10, 1). The 500 K is the temperature of the black body source of the incident radiation, 10 is the chopping frequency in Hz, and 1 is the bandwidth in Hz.

3. D* cmHz\(^1\)2W-1

This is a figure of merit for the material used in the detector and takes account of element size and signal to noise ratio. It is used to specify and compare detectors and in contrast to N.E.P., has a higher value for a better performance device.

D* is defined by the expression:
$$D^* = \frac{V_s}{V_n} \left[A \left(\triangle f \right) \right]^{\frac{1}{2}}$$

where V_S = Signal voltage across detector terminals

 V_n = Noise voltage across detector terminals

A = Detector area

 $(\triangle f)$ = Bandwidth of measuring amplifier

V = Radiated power incident on detector (r.m.s. value in watts)

The Noise Equivalent Power (N.E.P.) is related to D* by the expression:

N.E.P. =
$$\frac{(A)^{1/2}}{D^*}$$

MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors will be assessed at regular intervals against the requirements of the following IEC standards. The limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

	Test		Severity	Duration
IEC 68-2-3	Ca	Damp Heat, steady state	+20 °C, 70% RH	96 hours
68-2-20	Та	Solderability	+235 °C, 1.5 mm from header	5 seconds
68-2-21	Ub	Lead Fatigue	4 cycles	_
68-2-1	Aa	Low Temperature Storage	−20 °C	2000 hours
68-2-2	Ва	High Temperature Storage	+70 °C	2000 hours
68-2-14	Nb	Change of Temperature	-20 °C to +70 °C	10 cycles
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms ⁻²	2 h in each orientation
68-2-7	Ga	Acceleration, steady state	196000 ms ⁻²	60 seconds
68-2-27	Ea	Shock	14700 ms ⁻²	3 pulses 6 orientations
68-2-20	Tb	Resistance to Solder Heat	+350 ^o C, 6 mm from header	3 seconds



MOVEMENT SENSING USING A MULTI-ELEMENT FRESNEL LENS

1. INTRODUCTION

Our pyroelectric sensors are used extensively in passive infrared movement sensing applications where high sensitivity, reliability and low cost are basic requirements.

Although these sensors may be used directly to monitor scene thermal changes, it is generally advantageous to employ collecting optics to focus radiation on to the device. Thin, highly transmitting Fresnel lenses can collect infrared radiation very efficiently and provide optical gain over a defined field of view. This publication reviews the basic properties of Fresnel lenses in terms of geometric optics and describes the use of our Fresnel lens, which has been developed for general purpose movement sensing applications.

2 THE PROPERTIES OF ERESNEL LENSES.

2.1 The Fresnel Lens

In applications such as movement sensing, it is often necessary to employ short focal length, large aperture lenses, to collect sufficient radiation from what may be a weak or distant source. Unfortunately, the unavoidable thickness of such lenses rules out standard lens materials because of absorption losses. On the other hand, materials which have very low absorption, over the 6 to 14 µm wavelength range, are generally too expensive for commercial use.

Fresnel lenses, however, offer a neat solution to such problems since they can be produced in extremely thin sheets and thus allow the use of materials which have relatively poor transmission (e.g. polyethylene). They are essentially equivalent to thick conventional lenses, but with most of the bulk material between the outer surfaces removed. Without elaborating further, the equivalence of both types of lenses can be shown by considering the laws of refraction. This shows that the ray bending or refracting power of a lens is a function of surface curvature (and material refractive index) rather than the path length within the body of the lens.

In modern Fresnel lens designs, the profile of each groove facet is determined by computer simulation to produce the sharpest possible image from a distant object.

Although it is possible to produce Fresnel lenses of very large area, the effects of total internal reflection dictate that it is not useful to have a lens diameter much greater than the focal length. Radiation reaching areas beyond this is merely reflected back into the lens.

2.2 Lens operation and formulae

This section reviews the properties of lenses in terms of geometrical optics. This idealized approach gives sufficiently accurate results for most practical situations.

2.2.1. Focusing and imaging formulae

A lens is a device having refracting power and can be used to collect parallel rays (radiation) and focus them at a single point. The greater the refracting power of a lens, the closer the focal point will be to the lens. Focal length is defined as the distance between the focal point and lens centre and is a basic measure of the radiation gathering ability of a lens.

The focal length of a thin, plano-convex lens is given by:

$$\frac{1}{f} = (n-1) \frac{1}{r}$$

Where n represents the lens refractive index (approx. 1.5 for polyethylene) and r is the lens radius of curvature at its centre.

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FRESNEL LENS

Object and image positions are related by the standard formula.

$$\frac{1}{f} = \frac{1}{\varrho'} - \frac{1}{\varrho}$$

Where ℓ and ℓ' are object and image distances respectively. Details regarding sign convention for this formula can be found in Reference 1.

An implication of this formula is that all rays pass through the lens centre undeviated. This can be seen by considering rays from a small object h, placed on one side of the lens, as shown in Figure 1, where ℓ is greater than f.

For clarity only two extreme and one central ray are shown per object point. These are just particular rays in what is in fact a ray cone or bundle.

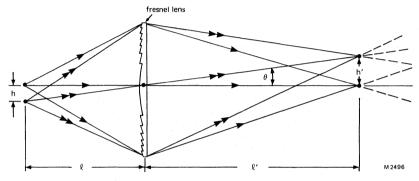


Figure 1 Image and object positions

A simple relationship exists between object and image size. By similar triangles, the magnification (M) is given directly as:

$$M = \frac{h'}{h} = \frac{\ell'}{\ell}$$

Where h and h' are object and image heights respectively.

Manipulation of the standard formula yields two further useful expressions for magnification:

$$M = 1 - \frac{\ell'}{f} \text{ and } M = \frac{1}{\frac{\ell}{f} + 1}$$

The effect of positioning an object about the focal point is shown in Figure 2.

When the object is precisely at the focal point P_1 , the rays refracted by the lens emerge parallel to each other. Shifting the object away from the lens to P_2 causes the emergent rays to converge to a point P_2 . A shift towards the lens creates a divergent ray bundle.

Since the path of light rays is reversible, the points P_2 and P_2 ' are interchangeable. A radiating source (object) at P_2 ' will be imaged at P_2 the usual position for a sensing element. Moreover, radiation from a source positioned on the right hand side of the lens will be directed on to P_2 (the sensor), provided they are of the appropriate direction and within the

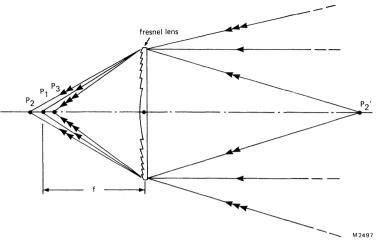


Figure 2 Effect of object shift

system 'field of view' (see section 2.2.2). In all cases, the line joining the centres of the lens and the sensor defines the direction (sensing) axis.

Returning to Figure 1, it can be seen that the ray cones overlap least at the image points. Thus the images of two adjacent sensor elements placed at P_2 (Figure 2), will be sharply defined and separated only near P_2 .

2.2.2 Field of view

An optical instrument such as a telescope may be used to view a limited area of a distant scene. This area limit, or object field of view, applies equally well to a lens and sensor system. A small object, placed near the focal point of a lens as in Figure 1, has an angular field of view (θ) given approximately as:

$$\theta = \frac{h}{f}$$

(NOTE: This angle is not to be confused with the sensor field of view).

2.2.3 Lens radiation collection

Although focal length determines the refracting power of a lens, the amount of radiation collected is also dependent on the effective collecting area.

A lens imaging a very distant source has a radiation gathering ability given by:

Radiation collection =
$$\frac{K}{\text{f-number}^2}$$

Where f-number is the ratio of focal length over lens diameter and K is a constant.

An effective collecting area is implied in this expression. In general, it is simply the area within the rim of the lens; however, a lens inclined at an angle α to the direction axis has its effective area and collection reduced by a factor $\cos(90-\alpha)$.

Collection is further reduced because of decreased transmission and image degradation (aberrations) of a tilted lens; the latter causes radiation to be redirected outside the defined image area.

FRESNEL LENS

3. MULTI-ELEMENT FRESNEL LENSES (ARRAYS)

Fresnel lens arrays are becoming increasingly favoured as radiation collecting devices for use with pyroelectric sensors.

The discrete field of view monitored by each element, coupled with a moving source, modulates the radiation incident on the sensor and thus causes pyroelectric signal generation. Significant signals occur whenever a thermal source passes from an unmonitored to monitored area, or vice versa.

By distributing many elements over the area of the array, extended coverage can be achieved. Fresnel lens arrays have many advantages over equivalent reflecting optics arrays. Briefly these are:

- Less bulky and lighter
- Can be used without external windows
- Do not require specialized coating
- Cheaper to produce both in tooling and quantity unit costs

3.1 Our Fresnel lens array

We have developed a low cost Fresnel lens array for use with our sensors, suitable for general purpose movement sensing applications. It is designed to provide high sensitivity, long range monitoring up to a least 12 metres, with 90° volumetric coverage.

The lens specification is outlined in Table 1 and Figure 3.

Table 1 Lens Specification/Data

Material	polyethylene	
Nominal average transmission	50	%
Number of monitored zones	A = 8 B = 4 C = 3	
Nominal coverage	12 metres x 90	o
Focal length	30.5	mm

MECHANICAL DATA

For mounted lens

Nominal dimensions in mm

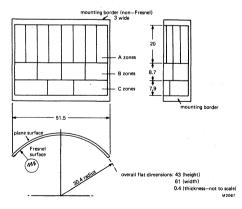


Figure 3 Lens mechanical data

The important features of the lens are: -

- A 15 element design which provides high signal sensitivity and movement discrimination.
- High quality optics match the imaging requirements of dual element sensors. Single element sensors may also be used, with reduced coverage (i.e. 50% fewer zones).
- Fresnel groove depth and thus transmission is constant over whole lens area.
- All elements are designed to give optimum radiation collection at the range limit aspheric groove contours minimize image aberrations.
- Each element includes part of the central ring which maintains high collection efficiency
 less loss due to inter-groove shadowing, scattering and diffraction.
- Can be used grooves-in or grooves-out, depending on requirements. In dusty
 environments grooves-in is recommended. If this is not the case, or if an external
 window is used, we recommend that the lens be used grooves-out, thus providing up to
 20% more signal than with grooves-in.

3.1.1 Typical usage and performance

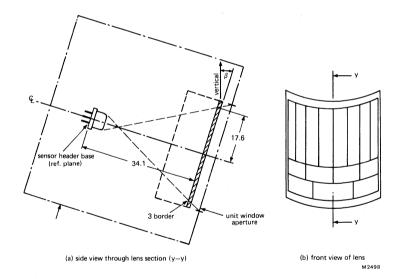


Figure 4 Typical mounting arrangement

A typical lens mounting arrangement is shown in Figures 4a and 4b, which represent the side and front views respectively. In Figure 4a the sensor plane and the lens section (y-y) are parallel and are inclined by an angle β to the vertical.

In this configuration all 'A' and 'B' elements are almost perpendicular to their respective direction axes (element to sensor centres), which ensures optimum collection along the zones. Objects positioned at the range limit are essentially in focus on the sensor. In addition, the system field of view is such that a human outline, at this range, just fills a 2 x 1 mm sensor area.

FRESNEL LENS

Nominal zonal coverage, corresponding to β = 12° and a fixing height of 2.1 metres, is depicted in Figures 5 and 6.

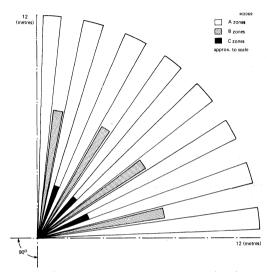


Figure 5 Nominal zonal coverage - plan view

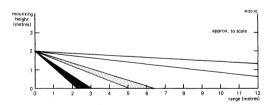


Figure 6 Nominal zonal coverage - side view

The minimum window aperture for the enclosure can be determined with reference to Figure 4a; namely by extending the dotted line from sensor to lens edges (vertically and horizontally) until they intersect the enclosure face.

A typical curve of sensor response against target range, for a single 'A' zone is shown in Figure 7. Because pyroelectric signal generation is proportional to radiant energy differences, this response curve will be strongly dependent on both background and target temperatures. The reduction of signal at short range results from minor cancellation effects. Such effects occur whenever both elements of a dual element sensor receive a proportion of energy from the same source.

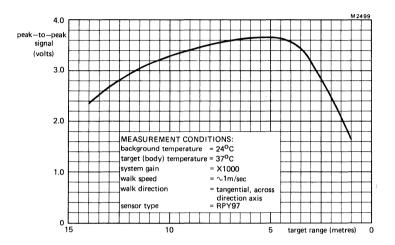


Figure 7 Typical signal level as a function of target range

3.1.2 Alternative mounting configurations

Although the mounting arrangement in Figure 4 will be suitable for most general applications, particular situations may dictate alternative configurations. Useful alternative mounting arrangements fall into two categories, a) where the unit is repositioned as a whole, and b) where the lens is repositioned relative to the sensor. Unit orientation and mounting height fall into the first category, whilst a different lens tilt angle, relative to a fixed sensor position, belongs to the latter category. The effect on system performance associated with any such changes needs careful consideration, particularly with regard to changes in zonal coverage and signal response.

The monitoring of a small room is one example where improved performance will be obtained by changes to the standard mounting arrangement. More effective coverage and increased signal levels will be achieved by inclining the zone-fan downwards or by shifting the whole zone-fan vertically downwards. The former can be achieved by a downward tilt of the unit whilst the latter simply requires a reduction in fixing height. In both cases, moving the lens and sensor as a unit does not affect the position of zones relative to one another.

FRESNEL LENS

The lens may be used equally well in other configurations where constraints such as unit shape restrictions dictate. In cases where it is necessary to change the position/orientation of the lens relative to the sensor, consideration must be given to associated changes in focusing as well as zonal coverage and signal response.

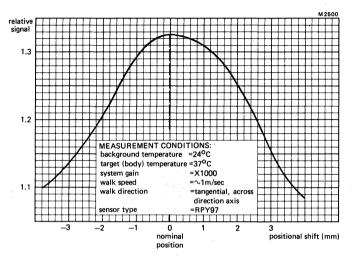


Figure 8 Typical relative signal as a function of sensor position

For guidance, a plot of signal sensitivity versus sensor position, for a single 'A' zone, is given in Figure 8, where the peak of the curve corresponds to the sensor in its nominal position. At this point, the image of the object at the design range is sharply defined so as to ensure minimum signal cancellation, after image motion across the elements.

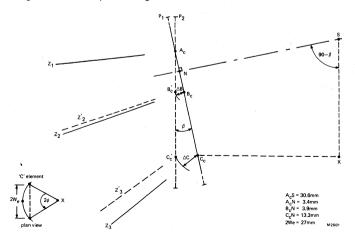


Figure 9 Zonal coverage as a function of lens tilt

The effect of lens tilt angle on zonal coverage is illustrated in Figure 9, where lens position P_1 corresponds to a 12^O tilt for nominal zonal coverage. Only the central vertical section of the lens is shown. A_C is an 'A' zone element centre, and is taken as being the section. B_C and C_C are the corresponding points for the B and C elements and S is the sensor position. S, A_C , B_C and C_C define the direction axes Z_1 , Z_2 and Z_3 for position P_1 . Note that the outer elements also define direction axes in space but have been omitted for clarity.

Another lens position of particular interest is that with the lens vertical (zero tilt) which corresponds to P_2 in the diagram. To maintain the nominal 'A' zone direction, the lens has been vertically rotated about A_c . This rotation also ensures that 'A' zone focusing is unaffected. Although direction axis Z_1 is common to position P_2 the new directions for the 'B' and 'C' zones become Z'2 and Z'3. Thus the zone-fan is compressed vertically, and the greatest shift occurs along the C element direction. Even so, the 'aiming' points of the 'B' and 'C' zone axes are shifted by only approx. 400 mm, along the floor. Such small shifts can be compensated for by repositioning the sensor along A_cS , at the penalty of 'A' zone defocusing.

For all tilt angles other than 0°, the inclination of the extreme zones differs slightly from the central ones of any row. Over a lens tilt range of 0 to 14° (fixed sensor position), however, the effect is of little practical significance. At 12° tilt, for instance the extreme 'A' zone aims at a point approx. 500 mm above the central 'A' zone, at 12 metres range. Because of the shorter distances involved, the effect is also insignificant for the 'B' and 'C' zones.

The projected angle of any zone fan onto the horizontal plane is also affected by lens tilt. For tilt angles below 14° the effect is small, and may be neglected for the 'A' and 'B' zones, given fixed S and rotation as in the diagram. For the 'C' zones, the sine of the projected zone fan semi-angle ϕ changes from:

$$\begin{split} \sin\phi &\approx \frac{W_e}{C_c X} \approx \frac{W_e}{C'_c X - A_c C_c \sin\beta} \quad \text{to} \\ \sin\phi &\approx \frac{W_e}{C'_c X} \end{split} \qquad \text{after rotation,}$$

where $C'_cX = A_cN \sin \beta + SN \cos \beta$ and W_e is the half-distance between the outer 'C' zone elements (see plan view inset). With the geometry of the lens given, simple trigonometry can be used to calculate the changes in fan angle. The total projected 'C' zone fan-angle is approximately 60° for a 14° tilt and changes to 52° at zero tilt.

Although the element to sensor distance $A_{c}S$ is taken to be fixed after rotation, lens geometry is such that the focusing distance of all 'A' zone elements, (to S) also remains essentially constant. This is not the case for the 'B' and 'C' element focusing distances, which are increased by ΔB and ΔC , respectively. For both these rows of elements, images which are sharply focused at S, now correspond to object points much closer to the lens. As a consequence of defocusing, increased cancellation effects reduce signal levels for the 'B' and 'C' zones at maximum range (see Figure 7); because of the proximity of object sources, the effect is less significant for the 'B' zones.

FRESNEL LENS

Because of the factors outlined in section 2.2.3, signal reduction also occurs as a direct result of lens inclination to the direction axis. For the 'A' zones, lens inclination to Z_1 is similar for both $0^{\rm O}$ and $12^{\rm O}$ tilt, so that radiation collection is unchanged. The 'B' and 'C' direction axes, however, are increasingly inclined to the lens after rotation to P_1 . Typical signal reduction factors versus lens inclination angle α can be estimated from the curve in Figure 10. In this case, the additional signal reduction for the 'B' and 'C' zones after rotation, is approximately 50% and 60% respectively.

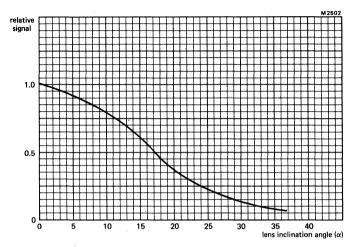


Figure 10 Typical relative signal as a function of lens inclination

Another factor which affects signal level is the sensor angle relative to a zone axis. This arises because sensor sensitivity is approximately dependent on the cosine of the angle between the sensor normal and the direction of incident radiation. In general, directing the sensor axis along SN provides a reasonable compromise. In this condition, the sensor response is within approx. 5% of maximum for both 'A' and 'B' zones, where maximum corresponds to radiation at normal incidence (0°). The effective sensitivity of the sensor for the 'C' zone is within approx. 15% of maximum.

If desired, the optimum response may be achieved from one zone row by orientating the sensor vertically towards the effective centre of the central zone element; for the 'A' zones this corresponds approximately to a horizontal position of the sensor axis. Similarly, optimum response along the 'B' or 'C' zones can be achieved by directing the sensor axis at the centre of the appropriate element. Naturally, directing the sensor to favour a particular zone row reduces the signal response for the other rows.

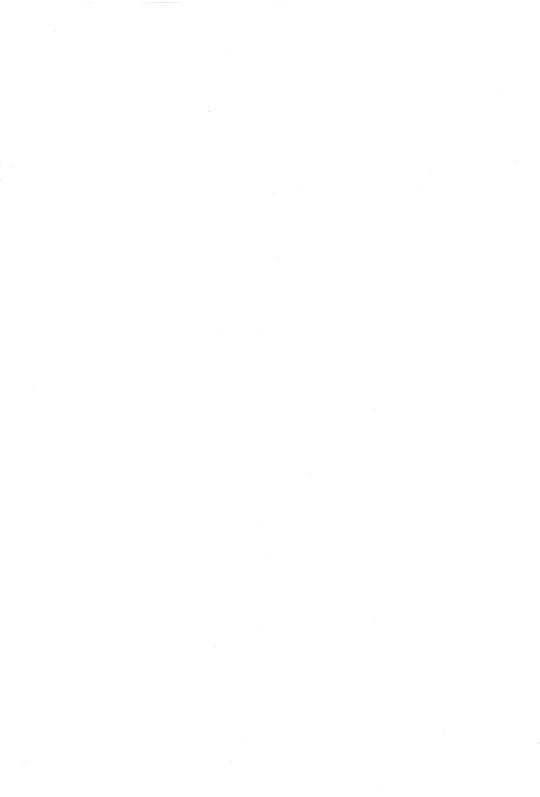
In any particular configuration, account must be taken of any signal reduction factors e.g. lens inclination to a direction axis. Such factors will modify the signal sensitivity versus range curve. Because some of the effects associated with lens/sensor movement can independently affect signal cancellation, e.g. focusing and zonal coverage density, and because of the nature of real sources, the modification of overall response will only be approximated by the summation of all the separate reduction factors.

REFERENCE

1. Geometrical and physical optics, R.S. Longhurst (Longman).

ORDERING

The lens is available **only** in conjunction with one of **our** range of pyroelectric sensors and is obtainable by adding the suffix FL to **our** sensor part number.



INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
BA220	S1	SD	BAS29	S7/S1	Mm/SD	BAV101	S7/S1	Mm/SD
BA221	S1	SD	BAS31	S7/S1	Mm/SD	BAV 102	S7/S1	Mm/SD
BA223	S1	Т	BAS32	S7/S1	Mm/SD	BAV103	S7/S1	Mm/SD
BA281	S1	SD	BAS35	S7/S1	Mm/SD	BAW56	S7/S1	Mm/SD
BA314	S1	Vrg	BAS45	S1	SD	BAW62	S1	SD
BA315	S1	Vrg	BAS56	S1/S7	SD/Mm	BAX12	S1	SD
BA316	S1	SD	BAT17	S7/S1	Mm/T	BAX14	S1	SD
BA317	S1	SD	BAT18	S7/S1	Mm/T	BAX18	S1	SD
BA318	S1	SD	BAT54	S1/S7	SD/Mm	BAY80	S1	SD
BA423	S1	T	BAT74	S1/S7	SD/Mm	BB112	S1	T
BA480	S1	T	BAT81	S1	T	BB119	S1	Т
BA481	S1	T	BAT82	S1	T	BB130	S1	T
BA482	S1	T	BAT83	S1	T	BB204B	S1	T
BA483	S1	T	BAT85	S1	T	BB204G	S1	T
BA484	S1	T	BAT86	S1	T	BB212	S1	T
BA682	S1/S7	T/Mm	BAV10	S1	SD	BB215	S 7	Mm
BA683	S1/S7	T/Mm	BAV18	S1	SD	BB219	S 7	Mm
BAS11	S1	SD	BAV19	S1	SD	BB405B	S1	T
BAS15	S1	SD	BAV20	S1	SD	BB417	S1	T
BAS16	S7/S1	Mm/SD	BAV21	S1	SD	BB809	S1	T
BAS17	S7/S1	Mm/Vrg	BAV23	S7/S1	Mm/SD	BB909A	S1	Т
BAS19	S7/S1	Mm/SD	BAV45	S1	Sp	BB909B	S1	T
BAS20	S7/S1	Mm/SD	BAV70	S7/S1	Mm/SD	BBY31	S7/S1	Mm/T
BAS21	S7/S1	Mm/SD	BAV99	S7/S1	Mm/SD	BBY40	S7/S1	Mm/T
BAS28	S7/S1	Mm/SD	BAV100	S7/S1	Mm/SD	BC107	s3	Sm

Mm = Microminiature semiconductors

for hybrid circuits

SD = Small-signal diodes

Sm = Small-signal transistors

Sp = Special diodes

T = Tuner diodes

Vrg = Voltage regulator diodes

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	type no.	book	section	type no.	book	section	type no.	book	section
Γ	BC108	S 3	Sm	BC808	S 7	Mm	BCX17;R	S 7	Mm
ı	BC109	S 3	Sm	BC817	S7	Mm	BCX18;R	s7	Mm
	BC140	S 3	Sm	BC818	S 7	Mm	BCX19;R	s7	Mm
	BC141	S 3	Sm	BC846	s7	Mm	BCX20;R	s7	Mm
	BC146	53	Sm	BC847	s7	Mm	BCX51	s7	Mm
	BC160	s3	Sm	BC848	S7	Mm	BCX52	S 7	Mm
	BC161	s3	Sm	BC849	S7	Mm	BCX53	s7	Mm
-	BC177	S3	Sm	BC850	s7	Mm	BCX54	S7	Mm
	BC178	S3	Sm	BC856	s7	Mm	BCX55	S7	Mm
l	BC179	S 3	Sm	BC857	s7	Mm	BCX56	s7	Mm
l	BC200	S 3	Sm	BC858	s7	Mm	BCX68	S 7	Mm
	BC264A	S5	FET	BC859	s7	Mm	BCX69	S 7	mm
	BC264B	S5	FET	BC860	s7	Mm	BCX70*	s7	Mm
	BC264C	S5	FET	BC868	s7	Mm	BCX71*	s7	Mm
	BC264D	S5		BC869	S7	Mm	BCY56	S3	Sm
	BC264D	55	FET	BC003	31	PIM	BC136	23	SIII
	BC327;A	S 3	Sm	BCF29;R	S7	Mm	BCY57	S 3	Sm
	BC328	S 3	Sm	BCF30;R	S7	Mm	BCY58	S 3	Sm
	BC337:A	53	Sm	BCF32;R	S7	Mm	BCY59	S 3	Sm
	BC338	53	Sm	BCF33;R	S7	Mm	BCY70	S 3	Sm
	BC368	S3	Sm	BCF70;R	s7	Mm	BCY71	S 3	Sm
				D. G. T. O. A. D.	a 7	•			_
	BC369	S 3	Sm	BCF81;R	s7	Mm	BCY72	s3	Sm
	BC375	S 3	Sm	BCV26	s7	Mm	BCY78	S3	Sm
	BC376	S3	Sm	BCV27	S7	Mm	BCY79	S3	Sm
	BC546	s3	Sm	BCV61	s7	Mm	BCY87	S3	Sm
	BC547	S 3	Sm	BCV62	s7	Mm	BCY88	s3	Sm
	BC548	S 3	Sm	BCV71:R	s 7	Mm	BCY89	s3	Sm
	BC549	S3	Sm	BCV72:R	S 7	Mm	BD131	S4a	P
	BC550	S3	Sm	BCW29;R	S7	Mm	BD132	S4a	P
	BC556	S 3	Sm	BCW30:R	S7	Mm	BD135	S4a	P
	BC557	s3	Sm	BCW31;R	S 7	Mm	BD136	S4a	P
-		- 2		D. 07123 0 D	0.7		107		_
	BC558	S3	Sm	BCW32;R	S7	Mm	BD137	S4a	P
	BC559	S 3	Sm	BCW33;R	S7	Mm	BD138	S4a	P
	BC560	S3	Sm	BCW60*	S7	Mm	BD139	S4a	P
	BC635	·S3	Sm	BCW61*	S7	Mm	BD140	S4a	P
	BC636	s3	Sm	BCW69;R	S7	Mm	BD201	S4a	P
	BC637	s3	Sm	BCW70;R	s7	Mm	BD202	S4a	P
	BC638	S3	Sm	BCW71;R	s7	Mm	BD203	S4a	P
	BC639	S3	Sm	BCW72;R	s7	Mm	BD204	54a	P
1	BC640	53 53	Sm	BCW81;R	s7	Mm	BD226	S4a	P
	BC807	53 57	Mm	BCW89;R	s7	Mm	BD227	S4a	P
L				<u> </u>					

⁼ series

FET = Field-effect transistors

Mm = Microminiature semiconductors for hybrid circuits

P = Low-frequency power transistors Sm = Small-signal transistors

type no.	book	section	type no.	book	section	type no.	book	section
BD228	S4a	P	BD335	S4a	P	BD839	S4a	P
BD229	S4a	P	BD336	S4a	P	BD840	S4a	P
BD230	S4a	P	BD337	S4a	P	BD841	S4a	P
BD231	S4a	P	BD338	S4a	P	BD842	S4a	P
BD233	S4a	P	BD433	S4a	P	BD843	S4a	P
BD234	S4a	P	BD434	S4a	P	BD844	S4a	P
BD235	S4a	P	BD435	S4a	P	BD845	S4a	P
BD236	S4a	P	BD436	S4a	P	BD846	S4a	P
BD237	S4a	P	BD437	S4a	P	BD847	S4a	P
BD238	S4a	P	BD438	S4a	P	BD848	S4a	P
BD239	S4a	P	BD645	S4a	Р	BD849	S4a	P
BD239A	S4a	P	BD646	S4a	P	BD850	S4a	P
BD239B	S4a	P	BD647	S4a	P	BD933	S4a	P
BD239C	S4a	P	BD648	S4a	P	BD934	S4a	P
BD240	S4a	P	BD649	S4a	P	BD935	S4a	P
BD240A	S4a	P	BD650	S4a	P	BD936	S4a	P
BD240B	S4a	P	BD651	S4a	P	BD937	S4a	P
BD240C	S4a	P	BD652	S4a	P	BD938	S4a	P
BD241	S4a	P	BD675	S4a	P	BD939	S4a	P
BD241A	S4a	P	BD676	S4a	P	BD940	S4a	P
BD241B	S4a	P	BD677	S4a	P	BD941	S4a	P
BD241C	S4a	P	BD678	S4a	P	BD942	S4a	P
BD247	S4a	P	BD679	S4a	P	BD943	S4a	P
BD242A	S4a	P	BD680	S4a	P	BD944	S4a	P
BD242B	S4a	P	BD681	S4a	P	BD945	S4a	P
BD242C	S4a	P	BD682	S4a	P	BD946	S4a	P
BD243	S4a	P	BD683	S4a	P	BD947	S4a	P
BD243A	S4a	P	BD684	S4a	P	BD948	S4a	P
BD243B	S4a	P	BD813	S4a	P	BD949	S4a	P
BD243C	S4a	P	BD814	S4a	P	BD950	S4a	P
BD244	S4a	P	BD815	S4a	P	BD951	S4a	P
BD244A	S4a	P	BD816	S4a	P	BD952	S4a	P
BD244B	S4a	P	BD817	S4a	P	BD953	54a	P
BD244C	S4a	P	BD818	S4a	P	BD954	S4a	P
BD329	S4a	P ·	BD825	S4a	P	BD955	S4a	P
BD330	S4a	P	BD826	S4a	P	BD956	S4a	P
BD331	S4a	P	BD827	S4a	P	BDT20	S4a	P
BD331	S4a	P	BD828	S4a	P	BDT21	S4a	P
BD332	54a	P	BD829	S4a	P	BDT29	S4a	P
BD334	S4a	P	BD830	S4a	P	BDT29A	S4a	P

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type no.	book	section	type no.	book	section	type no.	book	section
BDT29B	S4a	P	BDT62B	S4a	Р	BDV67A	S4a	P
BDT29C	S4a	P	BDT62C	S4a	P	BDV67B	S4a	P
BDT30	S4a	P	BDT63	S4a	P	BDV67C	S4a	P
BDT3OA	S4a	P	BDT63A	S4a	P	BDV67D	S4a	P
BDT30B	S4a	P	BDT63B	S4a	P	BDV91	S4a	P
DDISOD	340	.	DDIGGD	Jaa		BBV31	Dau	•
BDT30C	S4a	P	BDT63C	S4a	P	BDV92	S4a	P
BDT31	S4a	P	BDT64	S4a	P	BDV93	S4a	P
BDT31A	S4a	P	BDT64A	S4a	P	BDV94	S4a	P
BDT31B	S4a	P	BDT64B	S4a	P	BDV95	S4a	P
BDT31C	S4a	P	BDT64C	S4a	P	BDV96	S4a	P
		_			_	22115	~4	_
BDT32	S4a	P	BDT65	S4a	P	BDW55	S4a	P
BDT32A	S4a	P	BDT65A	S4a	P	BDW56	S4a	P
BDT32B	S4a	P	BDT65B	S4a	P	BDW57	S4a	P
BDT32C	S4a	P	BDT65C	S4a	P	BDW58	S4a	P
BDT41	S4a	P	BDT81	S4a	P	BDW59	S4a	P
BDT41A	S4a	P	BDT82	S4a	P	BDW60	S4a	p
BDT41B	S4a	P	BDT83	S4a	P	BDX35	S4a	P
BDT41C	S4a	P	BDT84	S4a	P	BDX36	S4a	P
BDT42	S4a	P	BDT85	S4a	P	BDX37	S4a	P
BDT42A	S4a	P P	BDT86	S4a	P	BDX42	S4a	P
BUITZA	Jaa	P	BD100	Sta	F	DDX42	544	-
BDT42B	S4a	P	BDT87	S4a	P	BDX43	S4a	P
BDT42C	S4a	P	BDT88	S 4 a	P	BDX44	S4a	P
BDT51	S4a	P	BDT91	S4a	P	BDX45	S4a	P
BDT52	S4a	P	BDT92	S4a	P	BDX46	S4a	P
BDT53	S4a	P	BDT93	S4a	P	BDX47	S4a	P
BDT54	S4a	P	BDT94	S4a	р	BDX62	S4a	P
		_	BDT95	54a S4a	P	BDX62A	S4a	P
BDT55	54a	P	BDT96	54a 54a	P	BDX62B	S4a S4a	P
BDT56	S4a	P	BDV64		-	BDX62B BDX62C	54a 54a	P
BDT57	S4a	P		S4a	P	1		P
BDT58	S4a	P	BDV64A	S4a	P	BDX63	S4a	P
BDT60	S4a	P	BDV64B	S4a	P	BDX63A	S4a	P
BDT60A	S4a	P	BDV64C	S4a	P	BDX63B	S4a	P
BDT60B	S4a	P	BDV65	S4a	P	BDX63C	S4a	P
BDT60C	S4a	P	BDV65A	S4a	P	BDX64	S4a	P
BDT61	S4a	P	BDV65B	S4a	P	BDX64A	S4a	P
DDmc4:	24	_	DDWCEG	64-		DDVC 45	0.4-	
BDT61A	S4a	P	BDV65C	S4a	P	BDX64B	S4a	P
BDT61B	S4a	P	BDV66A	S4a	P	BDX64C	S4a	P
BDT61C	S4a	P	BDV66B	S4a	P	BDX65	S4a	P
BDT62A	S4a	P	BDV66D	S4a	P	BDX65B	S4a	P
BDT62 BDT62A	S4a S4a	P. P	BDV66C BDV66D	S4a S4a	P P	BDX65A BDX65B	S4a S4a	P P

P = Low-frequency power transistors

type no.	book	section	type no.	book	section	type no.	book	sectio
BDX65C	S4a	P	BF256B	S 5	FET	BF593	S4b	HVP
BDX66	S4a	P	BF256C	S5	FET	BF620	S 7	Mm
BDX66A	S4a	P	BF324	s3	Sm	BF621	S 7	Mm
BDX66B	S4a	P	BF370	S 3	Sm	BF622	s7	Mm
BDX66C	S4a	P	BF410A	S 5	FET	BF623	S 7	Mm
BDX67	S4a	P	BF410B	\$ 5	FET	BF660;R	s7	Mm
BDX67A	S4a	P	BF410C	S5	FET	BF689K	S10	WBT
BDX67B	S4a	P	BF410D	S5	FET	BF763	S10	WBT
BDX67C	S4a	P	BF419	S4b	HVP	BF767	s7	Mm
BDX68	S4a	P	BF420	S 3	Sm	BF819	S4b	HVP
BDX68A	S4a	P	BF421	S 3	Sm	BF820	s 7	Mm
BDX68B	S4a	P	BF422	S 3	Sm	BF821	s7	Mm
BDX68C	S4a	P	BF423	S3	Sm	BF822	s7	Mm
BDX69	S4a	P	BF450	S3	Sm	BF823	s7	Mm
BDX69A	S4a	P	BF451	S 3	Sm	BF824	s7	Mm
BDX69B	S4a	P	BF457	s4b	HVP	BF840	s7	Mm
BDX69B	S4a S4a	P	BF458	S4b	HVP	BF841	S7	Mm
BDX77	S4a	P	BF459	S4b	HVP	BF857	S4b	HVP
BDX77	54a 54a	P	BF469	S4b	HVP	BF858	S4b	HVP
BDX 76	54a 54a	P	BF470	S4b	HVP	BF859	54b	HVP
DDV00	S4a	P	BF471	S4b	HVP	BF869	S4b	HVP
BDX92	54a 54a	P	BF472	54b	HVP	BF870	S4b	HVP
BDX93	54a 54a	P	BF483	S3	Sm	BF871	S4b	HVP
BDX94		P	BF485	S3	Sm	BF872	S4b	HVP
BDX95 BDX96	S4a S4a	P P	BF487	s3	Sm	BF926	54b 53	Sm
DDWAA	C.4 -	70	BF494	S3	Sm	BF936	S 3	C
BDY90	S4a	P	BF495	S3	Sm	BF936	53 53	Sm
BDY90A	S4a	P P	BF496	S3	Sm	BF960	S5	Sm FET
BDY91	S4a S4a	P P	BF510	S7/S5	Mm/FET	BF964	S5	FET
BDY92 BF198	54a 53	Sm	BF511	s7/s5	Mm/FET	BF966	S5	FET
DE100	s3	Sm	BF512	S7/S5	Mm/FET	BF967	S 3	Sm
BF199	53 53		BF512	S7/S5	Mm/FET	BF970	53 53	Sm Sm
BF240 BF241	53 53	Sm Sm	BF536	57/55 57	Mm	BF979	\$3 \$3	Sm Sm
BF245A	\$5 \$5	FET	BF550;R	s7	Mm	BF980	S5	FET
BF245B	S5	FET	BF569	s7	Mm	BF981	S5	FET
BF245C	S 5	FET	BF579	s7	Mm	BF982	S5	FET
	S5	FET	BF583	S4b	HVP	BF989	57/S5	
BF247A			BF585	54b 54b	HVP	BF999	S7/S5	Mm/Fl
BF247B	S5	FET	BF587		HVP	BF990	S7/S5	Mm/FF
BF247C	S5	FET	BF587	S4b S4b	HVP	BF991		Mm/FI
BF256A	S 5	FET	Br 33	340	nvr	01772	S7/S5	Mm/FE

FET = Field-effect transistors

HVP = High-voltage power transistors

Mm = Microminiature semiconductors for hybrid circuits

= Low-frequency power transistors

Sm = Small-signal transistors

WBT = Wideband transistors

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	type no.	book	section	type no.	book	section	type no.	book	section
	BF994	S7/S5	Mm/FET	BFQ63	S10	WBT	BFT46	S7/S5	Mm/FET
	BF996	S7/S5	Mm/FET	BFQ65	S10	WBT	BFT92;R	s7	Mm
	BFG23	S10	WBT	BFQ66	S10	WBT	BFT93;R	S 7	Mm
	BFG32	S10	WBT	BFQ67	S7	Mm	BFW10	S 5	FET
	BFG34	S10	WBT	BFQ68	S10	WBT	BFW11	S5	FET
				-					
	BFG51	S10	WBT	BFQ136	S10	WBT	BFW12	S5	FET
	BFG65	S10	WBT	BFR29	S5	FET	BFW13	S 5	FET
	BFG67	S7	Mm	BFR30	S7/S5	Mm/FET	BFW16A	S10	WBT
	BFG9OA	S10	WBT	BFR31	S7/S5	Mm/FET	BFW17A	S10	WBT
	BFG91A	S10	WBT	BFR49	S10	WBT	BFW30	S10	WBT
	BFG96	S10	WBT	BFR53;R	s7	Mm	BFW61	S 5	FET
1	BFP90A	S10	WBT	BFR54	S3	Sm	BFW92	S10	WBT
	BFP91A	S10	WBT	BFR64	S10	WBT	BFW92A	S10	WBT
	BFP96	S10	WBT	BFR65	S10	WBT	BFW93	S10	WBT
	BFQ10	S5	FET	BFR84	S5	FET	BFX29	S3	Sm
	DIVIO	55							
	BFO11	S5	FET	BFR90	S10	WBT	BFX30	S3.	Sm
1	BFQ12	S5	FET	BFR90A	S10	WBT	BFX34	S3	Sm
	BFQ13	S5	FET	BFR91	S10	WBT	BFX84	53	Sm
	BFQ14	S5	FET	BFR91A	S10	WBT	BFX85	S3	Sm
	BFQ15	S5	FET	BFR92;R	S7	Mm	BFX86	\$3	Sm
	DIQIS	55	121						
1	BFQ16	S5	FET	BFR92A:R	S7	Mm	BFX87	S3	Sm
	BFQ17	s7	Mm	BFR93:R	S 7	Mm	BFX88	S3	Sm
-	BFQ18A	S7	Mm	BFR93A;R	s7	Mm	BFX89	S10	WBT
1	BFQ19	S7	Mm	BFR94	S10	WBT	BFY50	S3	Sm
	BFQ22S	S10	WBT	BFR95	S10	WBT	BFY51	S 3	Sm
	2								
	BFQ23	S10	WBT	BFR96	S10	WBT	BFY52	S 3	Sm
	BFQ23C	S10	WBT	BFR96S	S10	WBT	BFY55	S3	Sm
	BFO24	S10	WBT	BFR101A;	B S7/S5	Mm/FET	BFY90	S10	WBT
1	BFQ32	S10	WBT	BFS17;R	S7	Mm	BG2000	S1	RT
l	BFQ32C	S10	WBT	BFS18;R	S7	Mm	BG2097	S1	RT
	~								
	BFQ32S	S10	WBT	BFS19;R	S7	Mm	BGD102	S10	WBM
	BFQ33	S10	WBT	BFS20;R	S7	Mm	BGD102E	S10	WBM
	BFQ34	S10	WBT	BFS21	S5	FET	BGD104	S10	WBM
	BFQ34T	S10	WBT	BFS21A	S5	FET	BGD104E	S10	WBM
	BFQ42	S6	RFP	BFS22A	S6	RFP	BGX11*	S2b	ThM
	BFQ43	S6	RFP	BFS23A	S6	RFP	BGX12*	S2b	ThM
1	BFQ51	S10	WBT	BFT24	S10	WBT	BGX13*	S2b	ThM
	BFQ51C	S10	WBT	BFT25;R	s7	Mm	BGX14*	S2b	ThM
	BFQ52	S10	WBT	BFT44	S3	Sm	BGX15*	S2b	ThM
	BFQ53	S10	WBT	BFT45	S3	Sm	BGX17*	S2b	ThM
L									

^{* =} series

RT = Tripler

Sm = Small-signal transistors

WBM= Wideband hybrid IC modules

WBT = Wideband transistors

FET = Field-effect transistors

Mm = Microminiature semiconductors

for hybrid circuits

RFP = R.F. power transistors and modules

type no.	book	section	type no.	book	section	type no.	book	section
BGX25	S2a	ThM	BGY84A	S10	WBM	BLV95	S6	RFP
BGY22	S6	RFP	BGY85	S10	WBM	BLV96	S6	RFP
BGY22A	S6	RFP	BGY85A	S10	WBM	BLV97	S6	RFP
BGY23	S6	RFP	BGY93A	S6	RFP	BLV98	S6	RFP
BGY23A	S6	RFP	BGY93B	S6	RFP	BLV99	S6	RFP
BGY32	s6	RFP	BGY93C	s6	RFP	BLW29	S 6	RFP
BGY33	56	RFP	BLU20/12		RFP	BLW31	S6	RFP
BGY35	S6	RFP	BLU30/12		RFP	BLW32	S6	RFP
BGY36	S6	RFP	BLU45/12		RFP	BLW33	S6	RFP
BGY40A	S6	RFP	BLU50	S6	RFP	BLW34	S6	RFP
BGY40B	s6	RFP	BLU51	S6	RFP	BLW50F	56	RFP
BGY 41A	S6	RFP	BLU52	S6	RFP	BLW60	S6	RFP
BGY41B	S6	RFP	BLU53	S6	RFP	BLW60C	S6	RFP
BGY43	S6	RFP	BLU60/12		RFP	BLW76	S6	RFP
BGY45A	S6	RFP	BLU97	S6	RFP	BLW77	s6	RFP
DOWAED	96	DDD	Drugo	0.0	n nn	BLW78	S6	RFP
BGY45B	S6	RFP	BLU98	S6	RFP	BLW79	S6	RFP
BGY46A	S6	RFP	BLU99	S6	RFP	BLW80	S6	RFP
BGY46B	S6	RFP	BLV10	S6	RFP	BLW81	S6	RFP
BGY47	S6	RFP	BLV11	S6	RFP	BLW82	S6	RFP
BGY50	S10	WBM	BLV20	S6	RFP	20402		KII
BGY51	S10	WBM	BLV21	S6	RFP	BLW83	s6	RFP
BGY52	S10	WBM	BLV25	S6	RFP	BLW84	56	RFP
BGY53	S10	WBM	BLV30	S6	RFP	BLW85	S6	RFP
BGY54	S10	WBM	BLV30/12		RFP	BLW86	S6	RFP
BGY55	S10	WBM	BLV31	S6	RFP	BLW87	S 6	RFP
BGY56	S10	WBM	BLV32F	S6	RFP	BLW89	s6	RFP
BGY57	S10	WBM	BLV33	S6	RFP	BLW90	S6	RFP
BGY58	S10	WBM	BLV33F	S6	RFP	BLW91	S6	RFP
BGY58A	S10	WBM	BLV36	S6	RFP	BLW95	S6	RFP
BGY59	S10	WBM	BLV37	s6	RFP	BLW96	S6	RFP
BGY60	S10	WBM	BLV45/12	56	RFP	BLW97	S6	RFP
BGY61	S10	WBM	BLV57	S6	RFP	BLW98	S6	RFP
BGY65	S10	WBM	BLV59	S6	RFP	BLW99	\$6	RFP
BGY67	S10	WBM	BLV75/12		RFP	BLX13	s6	RFP
BGY67A	S10	WBM	BLV80/28		RFP	BLX13C	S6	RFP
BGY70	S10	WBM	BLV90	s6	RFP	BLX14	S6	RFP
BGY71	S10	WBM	BLV91	S6	RFP	BLX15	S6	RFP
BGY74	S10	WBM	BLV92	S6	RFP	BLX39	S6	RFP
BGY75	S10	WBM	BLV93	S6	RFP	BLX65	S6	RFP
BGY84	S10	WBM	BLV94	S6	RFP	BLX65E	S6	RFP

^{* =} series

RFP = R.F. power transistors and modules

ThM = Thyristor modules

WBM = Wideband hybrid IC modules

INDEX

type no.	book	section	type no.	book	section	type no.	book	section
BLX67	s6	RFP	BPX71	S8b	PDT	BSR56	S7/S5	Mm/FET
BLX68	S6	RFP	BPX72	S8b	PDT	BSR57	S7/S5	Mm/FET
BLX69A	S6	RFP	BR100/03		Th	BSR58	S7/S5	Mm/FET
BLX91A	S6	RFP	BR101	S 3	Sm	BSR60	S3	Sm Sm
BLX91CE		RFP	BRY39	s3	Sm	BSR61	S3	Sm
BLX92A	S6	RFP	BRY56	s3	Sm	BSR62	S 3	Sm
BLX93A	S6	RFP	BRY61	S7	Mm	BSS38	S3	Sm
BLX94A	S6	RFP	BRY62	s7	Mm	BSS50	S3	Sm
BLX94C	S6	RFP	BS107	S5	FET	BSS51	S3	Sm
BLX95	S6	RFP	BS 170	S5	FET	BSS52	S3	Sm
BLX96	S6	RFP	BSD10	S 5	FET	BSS60	S3	Sm
BLX97	S6	RFP	BSD12	S5	FET	BSS61	S 3	Sm
BLX98	S6	RFP	BSD20	S5/7	FET	BSS62	S 3	Sm
BLY85	S6	RFP	BSD22	S5/7	FET	BSS63;R	S7	Mm
BLY87A	s6	RFP	BSD212	S5	FET	BSS64;R	S7	Mm
BLY87C	s6	RFP	BSD213	S5	FET	BSS68	53	Sm
BLY88A	S6	RFP	BSD214	S5	FET	BSS83	S5/7	FET/Mm
BLY88C	S6	RFP	BSD215	S5	FET	BST15	S7	Mm
BLY89A	S6	RFP	BSR12;R	S7	Mm	BST16	S7	Mm
BLY89C	S6	RFP	BSR13;R	s7	Mm	BST39	S 7	Mm
BLY90	S6	RFP	BSR14;R	s7	Mm	BST40	S 7	Mm
BLY91A	S6	RFP	BSR15;R	s7	Mm	BST50	s7	Mm
BLY91C	S6	RFP	BSR16:R	s7	Mm	BST51	S7	Mm
BLY92A	S6	RFP	BSR17;R	s7	Mm	BST52	57 57	Mm
BLY92C	S6	RFP	BSR17A;R		Mm	BST60	S7	Mm
BBIJZC	30	KFF	DSK17A;K	31	rin	B3100	51	PILI
BLY93A	S6	RFP	BSR18;R	S7	Mm	BST61	S 7	Mm
BLY93C	S6	RFP	BSR18A;R	S7	Mm	BST62	S 7	Mm
BLY94	S6	RFP	BSR19; A	S7	Mm	BST70A	S5	FET
BLY97	S6	RFP	BSR20; A	S7	Mm	BST72A	S5	FET
BPF24	S8b	PDT	BSR30	S7	Mm	BST74A	S5	FET
BPW22A	S8a/b	PDT	BSR31	S 7	Mm	BST76A	S5	FET
BPW50	S8a/b	PDT	BSR32	S7	Mm	BST78	S5	FET
BPW71	58b	PDT	BSR33	S7	Mm	BST80	S5/S7	FET/Mm
BPX25	S8b	PDT	BSR40	s7	Mm	BST82	S5/S7	FET/Mm
BPX29	S8b	PDT	BSR41	s7	Mm	BST84	S5/S7	FET/Mm
DD1146	201						ar .ar	
BPX40	S8b	PDT	BSR42	S7	Mm	BST86	S5/S7	FET/Mm
BPX41	S8b	PDT	BSR43	s7	Mm	BST90	S5	FET
BPX42	S8b	PDT	BSR50	S 3	Sm	BST97	S5	FET
BPX61	S8b	PDT	BSR51	s3	Sm	BST 100	S5	FET
BPX61P	S8b	PDT	BSR52	S 3	Sm	BST 110	S5	FET

FET = Field-effect transistors
Mm = Microminiature semiconductors

for hybrid circuits
PDT = Photodiodes or transistors

RFP = R.F. power transistors and modules

Sm = Small-signal transistors

Th = Thyristors

	book	section	type no.	book	section	type no.	book	section
BST120	S5/S7	FET/Mm	BTW40*	S2b	Th	BUV82	S4b	SP
BST 122	S5/S7	FET/Mm	BTW42*	S2b	Th	BUV83	S4b	SP
BSV15	S3/5/	Sm	BTW43*	S2b	Tri	BUV89	S4b	SP
BSV16	S3	Sm	BTW45*	S2b	Th	BUV90; A	S4b	SP
BSV17	S3	Sm	BTW58*	S2b	Th	BUW11:A	S4b	SP
D5V17	33	SM.	DIWSO	525	111	Dow 11,11	515	51
BSV52;R	S 7	Mm	BTW59*	S2b	Th	BUW12;A	S4b	SP
BSV64	53	Sm	BTW63*	S2b	Th	BUW13,A	S4b	SP
BSV78	S5	FET	BTW92*	S2b	Th	BUW84	S4b	SP
BSV79	S5	FET	BTX18*	S2b	Th	BUW85	S4b	SP
BSV80	S5	FET	BTX94*	S2b	Tri	BUX46;A	S4b	SP
BSV81	S5	FET	BTY79*	S2b	Th	BUX47;A	S4b	SP
BSW66A	S3	Sm	BTY91*	S2b	Th	BUX48;A	S4b	SP
BSW67A	S3	Sm	BU426	S4b	SP	BUX80	S4b	SP
BSW68A	S3	Sm	BU426A	S4b	SP	BUX81	S4b	SP
BSX19	S3	Sm	BU433	S4b	SP	BUX82	S4b	SP
BSX20	S3	Sm	BU505	S4b	SP	BUX83	S4b	SP
BSX45	S3	Sm	BU506	S4b	SP	BUX84	S4b	SP
BSX46	S 3	Sm	BU506D	S4b	SP	BUX84F	S4b	SP
BSX47	S3	Sm	BU508A	S4b	SP	BUX85	S4b	SP
BSX59	S 3	Sm	BU5O8D	S4b	SP	BUX85F	S4b	SP
BSX60	s3	Sm	BU705	s4b	SP	BUX86	S4b	SP
BSX61	S 3	Sm	BU706	S4b	SP	BUX87	S4b	SP
BSY95A	S3	Sm	BU706D	S4b	SP	BUX88	S4b	SP
BT136*	S2b	Tri	BU806	S4b	SP	BUX90	S4b	SP
BT137*	S2b	Tri	BU807	S4b	SP	BUX98	S4b	SP
22.0.			2000.					
BT138*	S2b	Tri	BU804	S4b	SP	BUX98A	S4b	SP
BT139*	S2b	Tri	BU824	S4b	SP	BUX99	S4b	SP
BT149*	S2b	Th	BU826	S4b	SP	BUY89	S4b	SP
BT151*	S2b	Th	BUP22*	S4b	SP	BUZ 10	S9	PM
BT152*	S2b	Th	BUP23*	S4b	SP	BUZ 10A	S9	PM
	~01	_,	December 2	a 41	an.	D110 4 4	C 0	T)M
BT153	S2b	Th	BUS11;A	S4b	SP	BUZ11	S9	PM DM
BT155*	52b	Th	BUS12;A	S4b	SP	BUZ11A BUZ14	S9 S9	PM PM
BT157*	S2b	Th	BUS13;A	S4b	SP			
BTV24*	S2b	Th	BUS14;A	S4b	SP	BUZ15	S9	PM PM
BTV34*	S2b	Tri	BUS21*	S4b	SP	BUZ2O	S9	PM
BTV58*	S2b	Th	BUS22*	S4b	SP	BUZ21	S9	PM
BTV59*	S2b	Th	BUS23*	S4b	SP	BUZ23	S9	PM
BTV60*	S2b	Th	BUT11;A	S4b	SP	BUZ24	S9	PM
BTW23*	S2b	Th	BUT 11A	S4b	SP	BUZ25	S9	PM
BTW38*	S2b	Th	BUT11AF	S4b	SP	BUZ30	S9	PM

^{* =} series

FET = Field-effect transistors

Mm = Microminiature semiconductors for hybrid circuits

PM = Power MOS transistors

Sm = Small-signal transistors

SP = Low-frequency switching power transistors

Th = Thyristors

Tri = Triacs

INDEX

type no.	book	section	type no.	book	section	type no.	book	section
BUZ31	S9	PM	BUZ84A	S9	PM .	BYV22*	S2a	R
BUZ32	S 9	PM	BY228	S1	R	BYV23*	S2a	R
BUZ32	S9	PM	BY229*	S2a	R	BYV24*	S2a	R
BUZ34	S9	PM	BY249*	S2a	R	BYV26*	S1	R
BUZ35	S9	PM	BY260*	S2a S2a	R	BYV27*	S1/S2a	R
60233	57	PM	B1200"	32a	K	BIV2/	31/320	K
BUZ36	S9	PM	BY261*	S2a	R	BYV28*	S1/S2a	R
BUZ40	S9	PM	BY329*	S2a	R	BYV29*	S2a	R
BUZ41A	S9	PM	BY359*	S2a	R	BYV30*	S2a	R
BUZ42	S9	PM	BY438	S1	R	BYV32*	S2a	R
BUZ43	S 9	PM	BY448	S1	R	BYV33*	S2a	R
							_=	_
BUZ44A	S9	PM	BY458	S1	R	BYV34*	S2a	R
BUZ45	S9	PM	BY505	S1	R .	BYV36	S1	R
BUZ45A	S9	PM	BY509	S1	R	BYV39*	S2a	R
BUZ45B	S9	PM	BY527	S1	R	BYV42*	S2a	R
BUZ45C	S9	PM	BY584	S1	R	BYV43*	S2a	R
BUZ46	S9	PM	BY588	S1	R	BYV72*	S2a	R
BUZ5OA	S 9	PM	BY609	S1	R	BYV73*	S2a	R
BUZ50B	S9	PM	BY610	S1	R	BYV79*	S2a	R
BUZ53A	S 9	PM	BY614	S1	R	BYV92*	S2a	R
BUZ54	S 9	PM	BY619	S1	R	BYV95A	S1	R
								_
BUZ54A	S9	PM	BY620	S1	R	BYV95B	S1 .	R
BUZ60	S9	PM	BY707	S1	R	BYV95C	S1	R
BUZ 60B	S9	PM	BY708	S1	R	BYV96D	S1	R
BUZ63	S9	P M	BY709	S1	R	BYV96E	S1	R
BUZ63B	S9	PM	BY710	S1	R	BYW25*	S2a	R
BUZ64	S9	PM	BY711	S1	R	BYW29*	S2a	R
BUZ71	S9	PM	BY712	S1	R	BYW3O*	S2a	R
BUZ71A	S 9	PM	BY713	S1	R	BYW31*	S2a	R
BUZ72	S 9	PM	BY714	S1	R	BYW54	S1	R
BUZ72A	S 9	PM	BYD13*	S1	R	BYW55	S1	R
BUZ73A	S9	PM	BYD33*	S1	R	BYW56	S1	R
BUZ74	S9	PM	BYD73*	S1	R	BYW92*	S2a	R
BUZ74A	S9	PM	BYM56	S1	R	BYW93*	S2a	R
BUZ76	S9	PM	BYQ28*	S2a	R	BYW94*	S2a	R
BUZ76A	S9	PM	BYR29*	S2a	R	BYW95A	S1	R
BUZ8O	59	PM	BYT79*	S2a	R	BYW95B	S1	R
BUZ8OA	S9	PM	BYV10	S1	R	BYW95C	S1	R
BUZ83	S9	PM	BYV19*	S2a	R	BYW96D	S1	R
BUZ83A	S9	PM	BYV20*	S2a S2a	R R	BYW96E	S1	R
BUZ84	S9	PM	BYV21*	S2a S2a	R	BYX25*	S2a	R
D0204	33	E FI	BIAS I	32a	N	Dines	J24	

^{* =} series

PM = Power MOS transistors

R = Rectified diodes

type no.	book	section	type no.	book	section	type no.	book	section
BYX30*	S2a	R .	BZX93	S1	Vrf	CNY57AU	S8b	PhC
BYX32*	S2a	R	BZX94	S1	Vrf	CNY57U	S8b	PhC
BYX38*	S2a	R	BZY91*	S2a	Vrg	CNY62	S8b	PhC
BYX39*	S2a	R	BZY93*	S2a	Vrq	CNY63	S8b	PhC
BYX42*	S2a	R	BZY95*	S2a	Vrg	CQF24	S8b	Ph
BYX46*	S2a	R	BZY96*	S2a	Vrg	CQL10A	S8b	Ph
BYX50*	S2a	R	CFX13	S11	M	COL13A	S8b	Ph
BYX52*	S2a	R	CFX21	S11	M	COL16	S8b	Ph
BYX56*	S2a	R	CFX30	S11	M	CQS51L	S8a	LED
BYX90G	S1	R	CFX31	S11	M	CQS54	S8a	LED
BYX94	S1	R	CFX32	S11	М	CQS82L	S8a	LED
BYX96*	S2a	R	CFX33	S11	M	COS82AL	S8a	LED
BYX97*	S2a S2a	R R	CNG35	S8b	PhC	CQS82AL	S8a	LED
BYX98*	S2a S2a	R R	CNG36	58b	PhC	CQS86L	S8a	LED
BYX99*	S2a S2a	R R	CNR36	S8b	PhC	CQS93	S8a	LED
DIV))	52a	K	CIVICO	505	1110	CQ573	Jua	DED
BZD23	S1	Vrg	CNX21	S8b	PhC	CQS93E	S8a	LED
BZTO3	S1	Vrg	CNX35	S8b	PhC	CQS93L	S8a	LED
BZV10	S1	Vrf	CNX35U	S8b	PhC	CQS95	S8a	LED
BZV11	S1	Vrf	CNX36	S8b	PhC	CQS95E	S8a	LED
BZV12	S1	Vrf	CNX36U	S8b	PhC	CQS95L	S8a	LED
BZV13	S1	Vrf	CNX38	S8b	PhC	CQS97	S8a	LED
BZV14	S1	Vrf	CNX38U	S8b	PhC	COS97E	S8a	LED
BZV37	S1	Vrf	CNX39	S8b	PhC	CQS97L	S8a	LED
BZV46	S1	Vrq	CNX39U	S8b	PhC	CQT 10B	S8a	LED
BZV49*	S1/S7	Vrg/Mm	CNX44	S8b	PhC	CQT24	S8a	LED
BZV55*	s7	Mm	CNX44A	S8b	PhC	CQT60	S8a	LED
BZV85*	S1	Vrg	CNX46	S8b	PhC	CQT70	S8a	LED
BZWO3*	S1	Vrg	CNX48	S8b	PhC	COT8OL	S8a	LED
BZW14	S1	Vrg	CNX48U	S8b	PhC	CQV70(L)		LED
BZW70*	S2a	TS	CNX62	S8b	PhC	CQV70A(I		LED
BZW86*	S2a	TS	CNX72	S8b	PhC	CQV70U(I) 58a	LED
BZW91*	S2a S2a	TS	CNX82	58b	PhC	CQV700(1		LED
BZX55*	52a S1	Vrg	CNX91	58b	PhC	COV72(L)		LED
BZX70*	S2a	Vrg	CNX92	58b	PhC	COV80L	S8a	LED
BZX70* BZX75*	SZA S1	Vrg	CNY 17-1	S8b	PhC	COVSOR	S8a	LED
DUNIJ	51	41.9	0			C _x ,com	204	
BZX79*	S1	Vrg	CNY17-2	S8b	PhC	CQV80UL	S8a	LED
BZX84*	S7/S1	Mm/Vrg	CNY17-3	S8b	PhC	CQV81L	S8a	LED
BZX9O	S1	Vrf	CNY50	s8b	PhC	CQV82L	S8a	LED
BZX91	S1	Vrf	CNY57	S8b	PhC	CQW1OA(I		LED
BZX92	S1	Vrf	CNY57A	S8b	PhC	CQW10B(I)S8a	LED

^{* =} series

LED = Light-emitting diodes

M = Microwave transistors

Mm = Microminiature semiconductors

for hybrid circuits

Ph = Photoconductive devices

PhC = Photocouplers

R = Rectifier diodes

TS = Transient suppressor diodes

Vrf = Voltage reference diodes

Vrg = Voltage regulator diodes

type no. b	ook :	section	type no.	book	section	type no.	book	section
COW1OU(L)	S8a	LED	Fresnel-	S8b	A	LKE2004T	S11	м
CQW11B(L)		LED	lens			LKE2015T	S11	М
	S8a	LED	H11A1	S8b	PhC	LKE21004R	S11	М
COW2OA	S8a	LED	H11A2	S8b	PhC	LKE21015T	S11	М
CQW21	S8a	LED	H11A3	S8b	PhC	LKE21050T	S11	М
Sx2.								
COW22	S8a	LED	H11A4	S8b	PhC	LKE27010R	S11	М
CQW24(L)	S8a	LED	H11A5	S8b	PhC	LKE27025R	S11	M
COW54	S8a	LED	H11B1	S8b	PhC	LKE32002T	S11	M
CQW60(L)	S8a	LED	H11B2	S8b	PhC	LKE32004T	S11	M
CQW6OA(L)		LED	H11B3	S8b	PhC	LTE42005S	S11	M
COMeon(r)	S8a	LED	H11B255	S8b	PhC	LTE42008R	S11	M
CQW61(L)	S8a	LED	KMZ 10A	S13	SEN	LTE42012R	S11	M
CQW62(L)	S8a	LED	KMZ 10B	S13	SEN	LV1721E50F	S11	M
CQW89A	S8a/b	I .	KMZ 10C	S13	SEN	LV2024E45F	S11	M
CQW93	S8a	LED	KP100A	S13	SEN	LV2327E40F	S11	M
CQW95	S8a	LED	KP101A	S13	SEN	LV3742E16F		M
CQW97	S8a	LED	KPZ20G	S13	SEN	LV3742E24F		M
CQX24(L)	S8a	LED	KPZ21G	S13	SEN	LWE2015R	S11	M
CQX51(L)	S8a	LED	KTY81*	S13	SEN	LWE2025R	S11	M
CQX54(L)	S8a	LED	KTY83*	S13	SEN	LZ1418E100)RS11	М
COX54D	S8a	LED	KTY84*	S13	SEN	MCA230	S8b	PhC
CQX64(L)	S8a	LED	LAE2001R	S11	M	MCA231	S8b	PhC
CQX64D	S8a	LED	LAE40010	S11	М	MCA255	S8b	PhC
CQX74(L)	S8a	LED	LAE4001R	S11	М	MCT2	S8b	PhC
COX74D	S8a	LED	LAE4002S	S11	M	MCT26	S8b	PhC
CQY11B	S8b	LED	LAE6000Q	S11	М	MKB12040WS	S11	M
CQY11C	S8b	LED	LBE1004R	S11	M	MKB12100WS	S11	M
CQY24B(L)	S8a	LED	LBE1010R	S11	M	MKB12140W	S11	M
CQY49B	S8b	LED	LBE2003S	S11	M	MO6075B200	ZS11	M
CQY49C	S8b	LED	LBE2005Q	S11	M	MO6075B400	ZS11	M
COY50	S8b	LED	LBE2008T	S11	м	MRB12175YF	Q11	м
CQY52	S8b	LED	LBE20095	S11	M	MRB12350YF		M
CQY53S	S8b	LED	LCE1010R	S11	M	MS1011B700		M
CQY54A	S8a	LED	LCE2003S	511	M	MS6075B800		M
COY58A	S8a/b	I	LCE2005Q	S11	M	MSB12900Y	S11	M
COLUM	Joarn	-	HCD2003Q	511	••	100123001	511	F-1
CQY89A	S8a/b	I	LCE2008T	S11	M	MZO912B753	S11	M
CQY94B(L)	S8a	LED	LCE2009S	S11	M	MZ0912B150		М
CQY95B	S8a	LED	LJE42002T	S11	M	OM286; M	S13	SEN
CQY96(L)	S8a	LED	LKE1004R	S11	M	OM287; M	S13	SEN
CQY97A	S8a	LED	LKE2002T	S11	M	OM320	S10	WBM

⁼ series

⁼ Accessories

⁼ Infrared devices

LED = Light-emitting diodes

⁼ Microwave transistors

PhC = Photocouplers

SEN = Sensors

WBM = Wideband hybrid IC modules

type no.	book	section	type no.	book	section	type no.	book	section
OM321	S10	WBM	OSS9215	S2a	St	PMBF4392	s7	Mm
OM322	S10	WBM	0SS9410	S2a	St	PMBF4392	s7	Mm
OM323	S10	WBM	OSS9415	S2a	St	PO44	S8b	PhC
OM323A	S10	WBM	P2105	S8b	I	PO44A	S8b	PhC
OM335	S10	WBM	PBMF4391	S 5	FET	PPC5001T	S11	M
OM336	s10	WBM	PBMF4392	S 5	FET	PQC5001T	S11	M
OM337	S10	WBM	PBMF4393	S 5	FET	PTB23001X	S11	M
OM337A	S10	WBM	PDE 100 1U	S11	М	PTB23003X	S11	M
OM339	S10	WBM	PDE1003U	S11	M	PTB23005X	S11	M
OM345	S10	WBM	PDE1005U	S11	M	PTB32001X	S11	M
OM350	S10	WBM	PDE1010U	S11	M	PTB32003X	S11	M
OM360	S10	WBM	PEE 100 1U	S11	M	PTB32005X	S11	M
OM361	S10	WBM	PEE1003U	S11	M	PTB42001X	S11	M
OM370	S10	WBM	PEE 1005U	S11	M	PTB42002X	S11	M
OM386B	S13	SEN	PEE1010U	S11	М	PTB42003X	S11	M
OM386M	S13	SEN	PH2222;R	S 3	Sm	PV3742B4X	S11	M
OM387B	S13	SEN	PH2222A; R	\$3	Sm	PVB42004X	S11	M
OM387M	S13	SEN	PH2369	S 3	Sm	PZ1418B15	J S11	M
OM388B	S13	SEN	PH2907;R	S 3	Sm	PZ1418B301	J S11	M
OM389B	S13	SEN	PH2907A;R	S 3	Sm	PZ1721B12	J S11	M
OM931	S4a	P	PH2955T	S4a	P	PZ1721B251	J S11	M
OM961	S4a	P	PH3055T	S4a	P	PZ2024B10	J S11	M
OSB9110	S2a	St	PH5415	S 3	Sm	PZ2024B201	J S11	M
OSB9115	S2a	St	PH5416	S 3	Sm	PZB16035U	S11	M
OSB9210	S2a	St	PH13002	S4b	SP	PZB27020U	S11	M
OSB9215	S2a	St	PH13003	S4b	SP	RPY97	S8b	I
OSB9410	S2a	St	PHSD51	S2a	R	RPY100	S8b	I
OSB9415	S2a	St	PKB3001U	S11	M	RPY 101	S8b	I
OSM9110	S2a	St	PKB3003U	S11	М	RPY 102	S8b	I
OSM9115	S2a	St	PKB3005U	S11	M	RPY 103	S8b	I
OSM9210	S2a	St	PKB12005U	S11	M	RPY107	S8b	I
OSM9215	S2a	St.	PKB20010U	S11	M	RPY 109	S8b	I
OSM9410	S2a	St	PKB23001U	S11	M	RV3135B5X	S11	M
OSM9415	S2a	St	PKB23003U	S11	М	RX1214B30	OYS11	M
OSM9510	S2a	St	PKB23005U	S11	M	RXB12350Y	S11	M
OSM9511	S2a	St	PKB25006T	S11	M	RZ1214B35	Y S11	M
OSM9512	S2a	St	PKB32001U	S11	M	RZ1214B60	W S11	M
0SS9110	S2a	St	PKB32003U	S11	M	RZ1214B65	Y S11	М
0SS9115	S2a	St	PKB32005U	S11	М	RZ1214B12		M
oss9210	S2a	St	PMBF4391	S7	Mm	RZ1214B12	5YS11	М

FET = Field-effect transistors

I = Infrared devices

M = Micriwave transistors

Mm = Microminiature semiconductors

for hybrid circuits

P = Low-frequency power transistors

PhC = Photocouplers

R = Rectifier diodes

SEN = Sensors

Sm = Small-signal transistors

SP = Low-frequency switching power transistors

St = Rectifier stacks

WBM = Wideband hybrid IC modules

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	135B15U		M	TIP132	S4a	P	1N4148	S1	SD
	135B15W		M	TIP135	S4a	P	1N4150	S1	SD
	135B25U		M	TIP136	S4a	P	1N4151	S1	SD
RZ3	135B30W	S11	M	TIP137	S4a	P	1N4153	S1	SD
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RZB	12350Y	S11	М	TIP141	S4a	P	1N4448	S1	SD
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1	502R	S8b	PhC	TIP2955	S4a	P	1N5060	S1	R
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TIF		S4a	P	1N3890	S2a	R	2N2219A	S 3	Sm
TIF		S4a	P	1N3891	S2a	R	2N2222	S3	Sm
1	110	S4a	P	1N3892	S2a	R	2N2222A	S3	Sm
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^{* =} series

M = Microwave transistors

= Low-frequency power transistors

PhC = Photocouplers R = Rectifier diodes SD = Small-signal diodes

Sm = Small-signal transistors

Vrf = Voltage reference diodes

WBT = Wideband transistors

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2N3375	S6	RFP	2N4857	S 5	FET	56245	53,10	A
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2N3822	S 5	FET	2N4860	S 5	FET	56264a,b	S2a/b	A
2N3823	S 5	FET	2N4861	S 5	FET	56295	S2a/b	A
2N3866	S6	RFP	2N5400	S 3	Sm	56326	S4b	A
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2N3905	S 3	Sm	2N5416	S 3	Sm	56353	S4b	A
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2N3924	S 6	RFP	2N5551	S 3	Sm	56359b	S2,4b	A
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2N3927	S6	RFP	2N6660	S5	FET	56359d	S2,4b	
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2N4O32	S 3	Sm	4N26	S8b	PhC	56367	S2a/b	A
2N4O33	S 3	Sm	4N27	S8b	PhC	56368a	S2,4b	A
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2N4123	S 3	Sm	4N37	S8b	PhC	56379	S2,4b	
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2N4125	S3	Sm	4N38A	S8b	PhC			

A = Accessories

FET = Field-effect transistors

Ph = Photoconductive devices

PhC = Photocouplers

RFP = R.F. power transistors and modules

Sm = Small-signal transistors -

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